

## Chapter 6 Surface Water

### 6.1 Environmental Setting/Affected Environment

California is characterized by 10 hydrologic basins, as shown in Figure 6.1. As described in Chapter 5, surface water that flows through the Delta and is conveyed by the State Water Project (SWP) and Central Valley Project (CVP) facilities primarily occurs in the Sacramento River and San Joaquin River hydrologic basins. A portion of the water from the Trinity River watershed in the North Coast hydrologic basin is conveyed by the CVP into the Sacramento River basin, as described in Chapter 5. Some of the SWP and CVP water supplies are conveyed in rivers and streams within Sacramento River and San Joaquin River basins, and thereby, affect surface water flows in those basins. In San Francisco Bay, Central Coast, South Coast, Tulare Lake, South Lahontan, and Colorado River hydrologic basins, SWP and CVP water supplies are conveyed in pipelines and canals and do not directly affect surface waters.

For the purposes of this analysis, the surface water study area specifically consists of the North Coast, Sacramento River and San Joaquin River basins, including the Delta and Suisun Marsh located at the confluence of the Sacramento and San Joaquin rivers. These surface waters represent the geographic areas where potential changes could occur to surface waters due to modifications in SWP and CVP water supply operations and implementation of habitat restoration in the Delta and Suisun Marsh in Restoration Opportunity Areas (ROAs) identified in the Bay Delta Conservation Plan alternatives.

Many topics related to surface water resources in the Sacramento River and San Joaquin River basins are also discussed in other chapters. Chapter 5, Water Supply, describes the overall surface water and groundwater supplies in California that are directly or indirectly affected by SWP and CVP water supply operations and implementation of habitat restoration in the ROAs. Chapter 8, Water Quality, describes surface water quality in Sacramento River and San Joaquin River basins. Chapter 7, Groundwater, describes groundwater characteristics in the Sacramento River and San Joaquin River basins that are directly or indirectly affected by changes in surface water characteristics.

#### 6.1.1 Potential Environmental Effects Area

The Sacramento River is the largest river in California and is bounded by the Cascade and Trinity mountains on the north, the Delta on the south, the Sierra Nevada on the east, and the Coast Range on the west. It drains a basin with an area of about 27,246 square miles and discharges to the Sacramento San Joaquin Delta (DWR 2009, Volume 3). The Sacramento River basin includes all or portions of 23 of the 58 counties in California. The Sacramento River extends approximately 365 miles from the slopes of Mount Shasta to Chipps Island in the Delta. The watershed also continues upstream of Mount Shasta to include the watersheds of the McCloud and Pit rivers and Squaw Creek.


The San Joaquin River is the second largest river in California. It drains about 32,000 square miles and discharges to the Sacramento-San Joaquin Delta (Bureau of Land Management, Wild and Scenic River Suitability Report for Bakersfield Field Office, California, July 2010). The San Joaquin River basin includes all or portions of 17 counties. The San Joaquin River extends approximately 330 miles

# Summary of Comments on untitled

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 Number: 1      Author: L2EDEEAK      Subject: Sticky Note      Date: 4/16/2012 8:49:18 AM

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Since during flood events at least 4000 cfs are diverted from the Tulare Lake Basin into the San Joaquin Basin, I believe it should be part of this discussion as well.

1 from the slopes of the Sierra Nevada near Thousand Island Lake on the Middle Fork to Chipps Island  
2 in the Delta. The watershed is hydrologically separated from the Tulare Lake watershed in the  
3 southern San Joaquin Valley by a broad ridge between the San Joaquin and Kings rivers.

4 The Sacramento and San Joaquin rivers join in the Delta and flow through Suisun Bay, San Pablo Bay,  
5 San Francisco Bay, and to the Pacific Ocean.

## 6 **6.1.2 Central Valley Hydrology**

7 The hydrology of the Sacramento River and San Joaquin River basins and Suisun Marsh are  
8 described below to support later discussions of environmental consequences associated with  
9 potential surface water changes resulting from temporary and permanent footprint of disturbance  
10 associated with construction of project water conveyance and related facilities and conservation  
11 components, as well as effects on surface water resources stemming from long term operations and  
12 existence of facilities and restored areas. The Tulare Lake basin is briefly described although the  
13 environmental consequences of the alternatives do not affect the surface waters in this basin.

### 14 **6.1.2.1 Sacramento River Basin**

15 The Sacramento River flows generally north to south from its source near Mount Shasta to the Delta  
16 near Freeport. The Sacramento River receives contributing flows from numerous major and minor  
17 streams and rivers that drain the east and west sides of the basin, including creeks upstream of the  
18 confluence with the Feather River (Cow, Battle, Cottonwood, Mill, Thomes, Deer, Stony, Big Chico  
19 and Butte creeks), Feather River (including flows from Yuba and Bear rivers), American River, Cache  
20 Creek that flows into Yolo Bypass which subsequently flows into the Cache Slough complex prior to  
21 flowing into the Sacramento River upstream of Rio Vista, as shown in Figure 6 3.

22 Sacramento River basin topography ranges in elevation from approximately 14,000 feet above sea  
23 level on Mount Shasta to approximately 1,070 feet at Shasta Dam to sea level in the Delta, as shown  
24 in Figure 6 2. Generally, precipitation occurs in the form of snow during winter and early spring at  
25 elevations above 5,000 feet. The snowmelt generally occurs in April and May.

26 As described in Chapter 5, Water Supply, flows in the Sacramento River are regulated by operation  
27 of Shasta and Keswick dams. Water diverted from Trinity River enters the Sacramento River  
28 through Keswick Reservoir. Major tributaries in the reach between Keswick Dam and Red Bluff  
29 include Clear and Cottonwood creeks on the west and Battle, Bear, Churn, Cow, and Payne creeks on  
30 the east. Major tributaries along the reach of the Sacramento River between Red Bluff and Verona  
31 are Antelope, Mill, Deer, Big Chico, Rock, and Pine creeks on the east and Reeds, Red Bank, Elder,  
32 Thomes, and Stony creeks on the west. The most northern of three flood bypass channels along the  
33 Sacramento River, Butte Slough, also is located in this reach.

34 The Feather River flows into the Sacramento River immediately upstream of Verona. The Feather  
35 River watershed is approximately 3,607 square miles and located on the east side of the Sacramento  
36 Valley (Reclamation 1997, p. III 5). The Feather River is the largest tributary to the Sacramento  
37 River below Shasta Dam. The Yuba River is a major tributary to the Feather River and flows into the  
38 Feather River near the town of Marysville (Reclamation 1997, p. III 5). The Yuba River watershed is  
39 approximately 1,339 square miles. The Bear River is another major tributary to the Feather River.

40 As described in Chapter 5, Water Supply, flows in the lower Feather River are regulated by  
41 operations of Oroville and Thermalito dams and diversions by Western Canal, Richvale Canal, the  
42 Pacific Gas and Electric Company (PG&E) Lateral, and the Sutter Butte Canal.

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Number: 1	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/16/2012 8:56:20 AM
Cache Creek should also be mentioned at this point.			
Number: 2	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/16/2012 9:08:01 AM
Wikipedia lists Bear River watershed as 295 square miles.			
Number: 3	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/16/2012 9:33:06 AM
Yuba River flows are regulated primarily by New Bullards Bar Dam.			
Number: 4	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/16/2012 9:20:55 AM
I don't believe I would call Butte Basin a Bypass as it is the natural basin taking water from Little Chico Creek, Butte Creek and Cherokee Canal from the east and diverted water from Sacramento River through Moulton Wier and Colusa Wier. The Butte Basin drains to the south into the manmade Sutter Bypass. The Sutter Basin (the natural overflow area of the Sacramento River is west of the Sutter Bypass.			



1 During flood events, a portion of the Feather River waters flow into the Tisdale Bypass and the  
2 associated Sutter Bypass, the second of the three floodbypass channels along the Sacramento River.

3 Downstream of Verona, the Sacramento River continues to the Delta. At the Fremont Weir,  
4 downstream of Knights Landing and upstream of Sacramento, a portion of the Sacramento River  
5 water flows into the Yolo Bypass during flood events. Yolo Bypass conveys flood flows from the  
6 Sacramento River and Sutter Bypass to Cache Slough for continued conveyance into the Sacramento  
7 River upstream of Rio Vista. The Sacramento Weir and Bypass conveys flood flows from the  
8 Sacramento River downstream of Fremont Weir and upstream of American River into Yolo Bypass.  
9 Yolo Bypass also conveys water from Knights Landing Ridge Cut, Willow Slough and Willow Slough  
10 Bypass, and Cache and Putah creeks located along the northern and western boundaries of Yolo  
11 Bypass. The capacity of the Yolo Bypass ranges from 343,000 cubic feet per second (cfs)  
12 downstream of Fremont Weir to 500,000 cfs near Rio Vista. The eastern boundary of the Yolo  
13 Bypass is formed by the levees of the Sacramento River Deep Water Ship Channel that was  
14 constructed in 1963. The bypass was inundated 46 years out of the 65 years between 1935 and  
15 1999 (CALFED 2000a).

16 The American River watershed is approximately 1,895 square miles. The American River joins the  
17 Sacramento River at the City of Sacramento approximately 20 miles downstream of Verona. As  
18 described in Chapter 5, Water Supply, flows in the lower American River are regulated by operation  
19 of Folsom and Nimbus dams. American River flows are regulated upstream of Folsom Lake by  
20 operations of several reservoirs owned and operated by Placer County Water Agency, El Dorado  
21 Irrigation District, and Sacramento Municipal Utility District.

22 The Sacramento River enters the Delta near Freeport downstream of the American River confluence.  
23 The flows at Freeport include the effects of upstream diversions to the Yolo Bypass. Flood channel  
24 capacity of the Sacramento River at Freeport is 80,000 cfs (DWR 2005).

25 Flows from the Yolo Bypass reenter the Sacramento River upstream of Rio Vista. Flows in the  
26 Sacramento River between Freeport and Rio Vista can be depleted by flows diverted through the  
27 Delta Cross Channel and Georgiana Slough when the SWP/CVP south Delta intakes are operational.

28 The surface water and groundwater systems in the Sacramento Valley are very strongly connected,  
29 as described in Chapter 7, Groundwater. The typically high groundwater levels in the Sacramento  
30 Valley cause the major rivers and the lower reaches of many of the tributary streams to gain flow  
31 through groundwater discharge. Surface water also seeps from the streams into the groundwater  
32 where groundwater elevations are lower than the stream water elevation and the surrounding soils  
33 are porous. The quantities of groundwater that discharge into surface streams and the quantities of  
34 surface water that percolate into underlying aquifers change temporally and spatially, and are  
35 poorly understood. Estimates of these surface water/groundwater exchange rates have been  
36 developed for specific reaches on a limited number of streams in the Sacramento Valley (USGS  
37 1985), but a comprehensive valley wide accounting has not been performed to date.

#### 38 **6.1.2.2 San Joaquin River Basin**

39 The San Joaquin River originates in the Sierra Nevada and then flows west into the San Joaquin  
40 Valley through Millerton Lake at Friant. The San Joaquin River turns north near Mendota and flows  
41 through the San Joaquin Valley and into the Delta near Vernalis. The San Joaquin river receives  
42 contributing flows from the Fresno, Chowilla, Merced, Tuolumne, Stanislaus, Calaveras,

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Actually a majority of the Sacramento River is diverted at the Fremont weir into the Yolo Bypass as the capacity of the Sacramento River downstream of the Fremont Weir is only 107000 cfs while the capacity of the Fremont Weir is 343000 cfs.

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Feather River does not flow into the Tisdale Bypass. During high flow a portion of the Sacramento River does flow into the Tisdale Bypass.


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
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I don't believe the Chowchilla River actually drains into the San Joaquin River but rather is diverted into Ash and Berenda Sloughs which do discharge into the San Joaquin River.

1 Mokelumne, and Cosumnes rivers, as shown in Figure 6 4. The Calaveras, Mokelumne, and  
2 Cosumnes rivers flow into the San Joaquin River within the boundaries of the Delta.

3 The San Joaquin River basin topography ges in elevation from over 10,000 feet above sea level in  
4 the Sierra Nevada to sea level in the Delta. Generally, precipitation occurs in the form of snow during  
5 winter and early spring at the upper elevations and snowmelt occurs in the late spring and early  
6 summer months. As described in Chapter 5, Water Supply, flows in the San Joaquin River are  
7 regulated by operation of Friant Dam, which diverts water into the CVP Friant Division (as described  
8 in Chapter 5, Water Supply) that conveys water in the Madera Canal to the north and the Friant  
9 Kern canal to south for irrigation and municipal and industrial water supplies in the eastern portion  
10 of the San Joaquin Valley, and releases water in the San Joaquin River meet downstream water rights  
11 and instream flow requirements. Hydropower generation facilities in the upper reaches of the San  
12 Joaquin river influence water flows into Millerton Lake (formed by Friant Dam). The water supply to  
13 the Friant Division was made available through an agreement with San Joaquin River water right  
14 holders (Exchange Contractors), who entered into an exchange contract and purchase agreement  
15 with Reclamation for delivery of water through the Delta Mendota Canal. Flood control releases  
16 from Friant Dam may be used to satisfy portions of deliveries to the San Joaquin River Exchange  
17 Contractors. Millerton Lake operations are coordinated with operations of the Delta Mendota Canal  
18 to manage releases, including flood control releases for the Exchange Contractors and other CVP  
19 water users (Reclamation 1999, p. 13 15).

20 In the San Joaquin River reach between Friant Dam and to locations upstream of Mendota Pool,  
21 including Gravelly Ford, flows in the river have historically been extremely low or not discernible  
22 from the surface. The ongoing San Joaquin River Restoration Program is developing a  
23 comprehensive long term effort to restore flows to the San Joaquin River from Friant Dam to the  
24 confluence of Merced River, ensure irrigation supplies to water diverted from Friant Dam, and  
25 restore a self sustaining fishery in the San Joaquin River. The San Joaquin River Restoration  
26 Program is a direct result of a September 2006 settlement on litigation to provide sufficient fish  
27 habitat in the San Joaquin River below Friant Dam between the U.S. Departments of the Interior and  
28 Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority. Federal  
29 legislation was reintroduced on January 4, 2007, to authorize federal agencies to implement the  
30 settlement. Interim flows began October 1, 2009, and full restoration flows are scheduled to begin  
31 no later than January 2014 (DWR 2009, p. S) 12).

32  A portion of the San Joaquin River flow is diverted into several bypasses during flood events.  
33 Upstream of the Mendota Pool and Mendota Dam, a portion of the flow is diverted into the  
34 Chowchilla Bypass that conveys water into the Eastside Bypass for further conveyance through  
35 Mariposa and Deep sloughs prior to discharge into the San Joaquin River near the confluence with  
36 the Merced River.

37 Fresno River flows from the Sierra Nevada foothills near Madera to Hensley Lake that is formed by  
38 Hidden Dam. Hidden Dam operations regulate the downstream Fresno River flows that flow into the  
39 Eastside Bypass and subsequently into the San Joaquin River near the confluence with the Merced  
40 River.

41 Chowchilla River flows approximately parallel to Fresno River from the Sierra Nevada foothills and  
42 flows into Eastman Lake formed by Buchanan Dam. Operations of the dam regulate the downstream  
43 reaches of the Chowchilla River that flows into the San Joaquin River downstream of the City of  
44 Chowchilla and upstream of the confluence of the Merced River and the San Joaquin River.

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Note at least 4000 cfs can enter the San Joaquin Watershed from the Tulare Lake Watershed through the Fresno Slough Bypass vis the Fresno Slough.

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Duck Slough, Owens Creek and Bear Creek and minor tributaries provide input into the San Joaquin River as well.

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Number: 3 Author: L2EDEEAK Subject: Sticky Note Date: 4/16/2012 9:52:03 AM

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The majority of the San Joaquin River flow is diverted into the Chowchilla Canal Bypass as 5500 cfs is the capacity of the bypass and the capacity of the San Joaquin River is only 2500 cfs and their juncture.

Surface Water

1 The Merced River originates in the Sierra Nevada and drains an area of approximately 1,273 square  
2 miles east of the San Joaquin River. Flows in the lower Merced River are regulated by operations of  
3 New Exchequer Dam that forms Lake McClure and three downstream dams. The Merced River is  
4 operated to meet water rights demands and instream flows and generate hydropower (Reclamation  
5 1999, p. 3 8). The Merced River flows into the San Joaquin River downstream of the confluences  
6 with Deep Slough and Salt Slough.





7 The Tuolumne River drains a watershed in the Sierra Nevada of approximately 1,540 square miles.  
8 Flows in the upper Tuolumne River are regulated by the operation of O'Shaughnessy Dam that forms  
9 the Hetch Hetchy Reservoir and is diverted into Hetch Hetchy conveyance system that is owned and  
10 operated by the San Francisco Public Utilities Commission. Flows in the lower Tuolumne River  
11 primarily are regulated by the operation of New Don Pedro Dam that forms Lake Don Pedro. The  
12 Tuolumne River is operated to meet water rights demands in the watershed, water rights held by  
13 San Francisco Public Utility Commission, and instream flows; and to generate hydropower. The  
14 Tuolumne River flows into the San Joaquin River upstream of Modesto.

15 The Stanislaus River originates in the Sierra Nevada and drains a watershed of approximately 900  
16 square miles. Snowmelt runoff contributes the largest portion of the flows in the Stanislaus River,  
17 with the highest monthly flows in April through June. Flows are regulated by New Melones Dam that  
18 forms New Melones Reservoir, and is operated as part of the CVP as described in Chapter 5, Water  
19 Supply. Releases from New Melones Dam are reregulated by operations of the downstream Tulloch  
20 and Goodwin dams. Stanislaus River is operated to meet water rights demands in the watershed,  
21 water rights held by Central San Joaquin Water Conservation District and the Stockton East Water  
22 District through CVP water service contracts, and instream flows; and to generate hydropower. The  
23 Stanislaus River flows into the San Joaquin River downstream of Modesto.

24 The San Joaquin River continues to flow to Vernalis. This reach of the river is influenced by flows  
25 from the San Joaquin River and return flows from agricultural operations that are supplied water  
26 from the San Joaquin River and the CVP Delta Mendota Canal. Vernalis is the location where the San  
27 Joaquin River enters the Delta. Flood warning levels occur on the San Joaquin River at 35,000 cfs.  
28 When the San Joaquin River flows at Vernalis exceeds 15,000 cfs, flows are diverted into Paradise  
29 Cut (south of the City of Lathrop). Downstream of Paradise Cut the San Joaquin River splits into  
30 several channels including the main river channel that flows Lathrop and Stockton; Middle River;  
31 and Old River. The Middle River and Old River channels are used by the SWP/CVP system to convey  
32 water from the Sacramento River to the SWP/CVP south Delta intakes, as described in Chapter 5,  
33 Water Supply. Middle River and Old River reconnect with the San Joaquin River downstream of the  
34 South Fork Mokelumne River and upstream of North Fork Mokelumne River.

35 The Calaveras River originates in the Sierra Nevada and drains an area of approximately 363 square  
36 miles. The Calaveras River watershed is almost entirely below the effective average snowfall level  
37 (5,000 feet) and receives nearly all of its flow from rainfall. As a result, nearly all of the annual flow  
38 occurs between December and April. Flows in the lower Calaveras River are regulated by New  
39 Hogan Dam that forms New Hogan. The Calaveras River is operated to meet water rights demands  
40 and instream flows, and flows into the San Joaquin River in the City of Stockton.

41 The Mokelumne River originates in the Sierra Nevada and drains a watershed of approximately  
42 661 square miles. Flows in the Mokelumne River are regulated by several upstream reservoirs  
43 including Salt Springs Reservoir on the North Fork Mokelumne River, operated by Pacific Gas &  
44 Electric Company to generate hydropower; and Pardee and Camanche reservoirs are on the main

	Number: 1	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/17/2012 10:40:48 AM
	Where on the San Joaquin River is this 32500 cfs measured? Vernalis?			
	Number: 2	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/16/2012 10:02:40 AM
	flows "west of" Lathrop and Stockton?			
	Number: 3	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/17/2012 10:41:46 AM
	It forms New Hogan "Lake"			
	Number: 4	Author: L2EDEEAK	Subject: Sticky Note	Date: 4/17/2012 10:39:57 AM
	Merced River originates in Yosemite National Park.			

1 stem of the Mokelumne River, operated by East Bay Municipal Utility District to export water to  
2 their service area in the eastern San Francisco Bay Area. Downstream of these reservoirs, the  
3 Mokelumne River is operated to meet water rights demands in the watershed and instream flows,  
4 including flow requirements for salmonid fish hatchery operated by East Bay Municipal Utility  
5 District. The mainstem Mokelumne River splits into the North and South Forks of the Mokelumne  
6 River at the southernmost tip of McCormack Williamson Tract near New Hope Landing. The North  
7 and South Forks of the Mokelumne River flow south and converge at the southwestern tip of Staten  
8 Island. The Mokelumne River terminates in the San Joaquin River south of Bouldin Island in the  
9 Delta. Water from the Sacramento River is conveyed into the Mokelumne River system through the  
10 operable gates at the CVP Delta Cross Channel (see Chapter 5, Water Supply) and Georgiana Slough  
11 which are located along the Sacramento River at Walnut Grove.

12 A major portion of the Cosumnes River water flows into the Mokelumne River near Thornton and a  
13 portion flows into the Sacramento River upstream of Walnut Grove through Lost Slough. The  
14 Cosumnes River originates in the lower elevations of the Sierra Nevada and drains a watershed of  
15 approximately 537 square miles. The Cosumnes River receives most of its water from rainfall. The  
16 Cosumnes River flows are not regulated by major facilities, although Sly Park Reservoir is located in  
17 the upper watershed to provide local water rights demands. Flows from the Cosumnes River are  
18 used by water rights holders in the watershed including several managed wetland areas.

19 The San Joaquin River flows through the Delta channels and joins the Sacramento River near  
20 Collinsville and flows into Suisun Bay. Several local tributaries flows form the Delta lowlands into  
21 the San Joaquin River within the Delta include Mosher Creek, Bear Creek, Duck Creek, Pixley Slough  
22 flow and Disappointment Slough.

### 23 **6.1.2.3 Delta Hydraulics**

24 The Delta is a complex network of over 700 miles of tidally influenced channels and sloughs. Three  
25 strong forcing mechanisms drive circulation, transport, and mixing of water in the Delta: (1)  
26 freshwater river flow from drainages to the Delta; (2) tides propagating from the Pacific Ocean  
27 through San Francisco Bay from the west; and (3) SWP and CVP water supply facilities operating in  
28 the south Delta (USGS 2005). Flow gages are located throughout the Delta, as shown in Figure 6 5.

#### 29 **Influence of Delta Inflows**

30 North Delta channels convey river flows that move south and west through the Sacramento River to  
31 the Delta. The Delta Cross Channel gates divert flows from the Sacramento River to facilitate flow  
32 toward the SWP/CVP south Delta intakes. Channel flows in the southern Delta are sensitive to  
33 export operations. Pumping can slow or reverse flows that would naturally go north and west in the  
34 San Joaquin River and associated channels towards the Delta. Temporary barriers and tidal flow  
35 throughout the Delta add further complexity to the circulation and mixing of waters (USGS 2005).

#### 36 **Influence of Delta Tidal Flows**

37 Tidal flows have a major influence on Delta hydraulics and vary with the extent of high and low  
38 tides. On average, tidal inflows to the Delta are approximately equal to tidal outflows. All tidal flows  
39 enter and leave the Delta along the San Joaquin River at Chipps Island.

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1 Sea level rise is another factor that has a notable influence on Delta hydraulics. Factors affecting sea  
2 level rise include tidal variations, storm surges, large scale changes in water temperature and wind  
3 forces, and climate related changes. Sea level has been rising at various rates over at least the past  
4 20,000 years, with the most rapid rise of about 120 meters occurring from about 18,000 to 5,000  
5 years ago. Data from a collection of tide gages indicate a global sea level rise rate of approximately  
6 1.8 millimeters per year during the twentieth century. For the period from 1993 to 2003, the global  
7 sea level rise rate is estimated to be approximately 2.8 millimeters per year using satellite altimetry  
8 data. Data from tectonically stable tide gages in California and other West Coast locations in the  
9 United States show similar rates. The occurrence of extremes in sea level rise has increased  
10 markedly since the early 1900s (Cayan et al. 2008).

## 11 **Influence of SWP and CVP Delta Operations**

12 The withdrawal rates at the south Delta intakes significantly influence Delta hydraulics and can  
13 change the direction of flow of some waterways in the south Delta. The most significant effects occur  
14 on Old and Middle Rivers, as described in Chapter 5, Water Supply. Reverse flows also occur in False  
15 River in the western Delta and Turner Cut Off in the San Joaquin River.

## 16 **South Delta Channels and Barriers**

17 The south Delta hydraulics are influenced by several channels that have been widened and/or  
18 connected and barriers to reduce connectivity between other channels to protect agricultural water  
19 uses or aquatic resources. Operations of these facilities affect operations of the SWP and CVP south  
20 Delta intakes.

21 Grant Line Canal and the Fabian and Bell Canal run in parallel and are commonly collectively  
22 referred to as the Grant Line Canal. The Grant Line Canal conveys flow from the San Joaquin River to  
23 the CVP south Delta intakes. The Grant Line Canal is approximately 9 miles long. The Fabian and Bell  
24 Canal begins near the Tracy Boulevard Bridge and continues to the downstream end of the Grant  
25 Line Canal, where it rejoins the Old River Channel just upstream of the Clifton Court Forebay.  
26 Approximately half of the flow diverted at the SWP/CVP south Delta intakes flows past Grant Line  
27 Canal through the portion of the Old River extending from Victoria Island to Bacon Island.

28 Middle River is a relatively narrow and shallow channel that extends from Victoria Canal to the San  
29 Joaquin River. In the lower 4 miles, from Victoria Canal to between the Tracy Boulevard and the  
30 Howard Road bridges, the channel has been dredged deeper and wider (DWR 2005).

31 Paradise Cut is a tidal slough located north of Tracy, approximately 6 miles long. It connects the San  
32 Joaquin and Old rivers.

33 Tom Paine Slough is isolated from tidal influences by siphons. It essentially operates as a lake,  
34 supplying approximately ten irrigation diversions. Portions of the channel have been dredged by  
35 Department of Water Resources (DWR) and South Delta Water Agency and siphons have been  
36 installed. In an effort to increase the water level maintained in Tom Paine Slough during unusually  
37 high tides, the gate operations were modified (DWR 2005).

38 Operation of barriers within the Delta has affects on water levels and flow and circulation patterns.  
39 The purposes of the barriers and gates are to:

- 40 □ Raise water surfaces for irrigation diversions
- 41 □ Control flow to local agricultural pumping plants

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1        □ Prevent fish from entering certain channels (fish protection)

2        □ Affect circulation patterns that can improve water quality

3        The locations of barriers and gates in the Delta are shown in Figure 6-6.

4        In the south Delta, four temporary rock barriers are installed annually. The barriers include  
5        openings that allow a portion of the flow to pass downstream, but most flow is redirected into other  
6        channels. The four barriers historically have been installed at Head of Old River Gate, Old River at  
7        Tracy Gate, Middle River Gate, and Grant Line Canal Gate. The Head of Old River Gate (also referred  
8        to as the Head of Old River Barrier, see Chapter 5, Water Supply) is intended to prevent the  
9        movement of Chinook Salmon into the southern Delta channels via the Old River and to reduce  
10       channel water salinity. This gate is operated from April to May and September to November each  
11       year. The other three barriers (besides the Head of Old River Gate) are agricultural gates that are  
12       operated between April 15 and November 30 each year and during other periods of high tide and  
13       flooding as needed. These gates benefit agriculture within the Delta by maintaining required water  
14       levels and improving circulation patterns, which can help improve water quality.

#### 15       **6.1.2.4       Suisun Marsh**

16       Suisun Marsh is the largest contiguous brackish water marsh in North America, encompassing  
17       approximately 180 square miles comprising managed wetlands, upland grasses, tidal wetlands,  
18       bays, and sloughs. Suisun Marsh is located west of the Delta. Water Right Decision 1485 (D 1485)  
19       issued by the State Water Resources Control Board in 1978 established channel water salinity  
20       standards and a water quality monitoring program and provided for the recently adopted Suisun  
21       Marsh Habitat Management, Preservation, and Restoration Plan (Reclamation 2011).

22       Suisun Marsh originally consisted of a group of islands separated by sloughs with inflow from tides  
23       and floods. In the 1860s and under federal and State legislation, reclamation of the swamps was  
24       accomplished through construction of a complex system of levees to develop managed seasonal  
25       wetlands and agriculture.

26       Both tidal and freshwater flows are conveyed into the marsh through an extensive network of  
27       sloughs. Green Valley, Suisun, Dan Wilson, Ledge wood, McCoy, and Denver ton creeks flow into  
28       Suisun Marsh from surrounding lands.

29       Several facilities have been constructed by DWR and Reclamation to maintain freshwater conditions  
30       in many portions of Suisun Marsh, including Suisun Marsh Salinity Control Gates, Morrow Island  
31       Distribution System, Roaring River Distribution System, Goodyear Slough Outfall, Lower Joice Island  
32       Unit, and the Cygnus Unit. The Suisun Marsh Salinity Control Gates are the primary facilities to  
33       maintain freshwater conditions and reduce tidal flows from Grizzly Bay into Montezuma Slough  
34       during incoming tides, and divert low salinity water from the Delta into Montezuma Slough. The  
35       Suisun Marsh Salinity Control Gates historically have operated from early October through May,  
36       depending on salinity conditions. The Roaring River Distribution System is designed to tidally pump  
37       water from the eastern end of Montezuma Slough to provide for the seasonal water needs of Suisun  
38       Marsh landowners and fisheries. The Morrow Island Distribution System consists of two channels  
39       that divert water from Goodyear Slough to the easternmost part of Morrow Island. Lower salinity  
40       water from Goodyear Slough is pumped into seasonal wetlands and drained into Grizzly Bay or  
41       Suisun Slough to prevent high salinity drainage water from entering Goodyear Slough. The  
42       Goodyear Slough outfall connects the southern end of Goodyear Slough to Suisun Bay, which

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1 increases circulation and reduces salinity in Goodyear Slough. The Lower Joice Island Unit intake  
2 culverts on Montezuma Slough and on Suisun Slough near Hunter Cut divert water into a managed  
3 wetland area. The Cygnus Unit was constructed to provide drainage to another area of Suisun  
4 Marsh.

#### 5 **6.1.2.5 Tulare Lake Basin**

6 The Tulare Lake watershed consists of approximately 17,000 square miles located at the southern  
7 end of the San Joaquin Valley (DWR 2009, p. TL 5). It is an area bounded by the Sierra Nevada to the  
8 east, the Tehachapi Mountains to the south, and the Coast Ranges to the east (DWR 2009, p. TL 5).  
9 Historically, the Kings, Kaweah, and Tule rivers flowed into the Tulare Lake Bed, and the Kern River  
10 flowed into the Kern, Buena Vista, and Goose lake beds or into adjacent wetlands and marshes (DWR  
11 2009, p. TL 5). Development of water supply and flood control projects on these rivers and drainage  
12 facilities in the lake beds transformed the lake beds into productive agricultural lands.

13 The Kings River, originating in Kings Canyon National Park, is regulated by Pine Flat Reservoir.  
14 Downstream of the reservoir, the South Fork flows to the Tulare Lake bed, and the North Fork flows  
15 to Fresno Slough (Reclamation 1997, p. II 56). During periods with flood releases from Pine Flat  
16 Reservoir, portions of Kings River flow are diverted through the James Bypass/Fresno Slough  
17 system to the San Joaquin River basin (DWR 2009, p. TL 7); or may flow through Fresno Slough to  
18 Mendota Pool along the San Joaquin River (Reclamation 1999, p. 13 15). It is only under these  
19 conditions that the Tulare Lake basin has a surface water outflow.

20 The Kaweah River, originating in Sequoia National Forest, is regulated by Kaweah Lake and flows  
21 into the Tulare Lake bed (DWR 2009, TL 7). The Tule River, also originating in Sequoia National  
22 Forest, is regulated by Lake Success and also flows into the Tulare Lake bed (DWR 2009, TL 7).

23 The Kern River originates in the Inyo and Sequoia National Forests and Sequoia National Park, and  
24 is regulated by Lake Isabella. The Kern River flows into the Kern Lake bed and continues to flows  
25 into the Buena Vista and Tulare Lake beds (DWR 2009, TL 7). Flows from the Kern River also may  
26 be diverted to the SWP California Aqueduct through the Kern River Intertie (DWR 2009, TL 7).


### 27 **6.1.3 Central Valley Flood Management**

28 Operations of surface waters in the Central Valley are affected by water supply requirements, as  
29 described in Chapter 5, Water Supply, and flood management operations, as described in this  
30 section.

#### 31 **6.1.3.1 Background of Central Valley Flood Management**

32 Development of the Delta began in 1848 to provide food for the communities that were established  
33 during the Gold Rush in the California foothills. In 1850, the Swamp and Overflowed Lands Act was  
34 passed by Congress, ceding federal swamplands to the states to encourage reclamation. In 1868, the  
35 State Tideland Overflow and Reclamation Act passed by the California Legislature enabled the  
36 creation of local reclamation districts, which led to the transfer of much of this public land into  
37 private ownership. Most of the original levees constructed to reclaim wetlands in the Delta during  
38 the mid 1800s were less than 5 feet high (Thompson 1982). These small levees initially allowed the  
39 marshlands to be drained and farmed. Later, large steam driven clamshell dredges were used to  
40 build and enlarge the levees to increase flood protection and to combat levee and land subsidence.

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it is also boarder "on the north by a broad ridge between the San Joaquin and Kings rivers"

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Surface Water

1 In some areas of the Delta, organic peats and mucks used in this construction were not ideal levee  
2 construction materials, and seepage problems commonly developed. Organic soil material  
3 commonly shrank or compressed with placement of additional levee fill. Construction of the levees  
4 on the soft soil often resulted in irregular settlement and the creation of large cracks and fissures in  
5 levee and foundation soils. The surfaces of the reclaimed land also subsided as a result of oxidation  
6 of the organic soils. Levees required constant maintenance to overcome the land subsidence and  
7 settling.

8 Hydraulic mining in the Sierra Nevada, beginning around 1853 and lasting approximately three  
9 decades, washed vast amounts of material into the streams and canyons, resulting in reduced  
10 channel capacity downstream and increased flooding in the Sacramento Valley and the Delta. In  
11 1893, the California Debris Commission was established to regulate hydraulic mining, planning for  
12 improved navigation, deepen channels, protect river banks, and afford relief from flood damages.  
13 The California Debris Commission began surveys of Sacramento Valley streams in July 1905 and  
14 developed a flood management plan in 1907. The plan included constructing and enlarging levees  
15 along rivers, creating bypasses to convey flows greater than the river's capacity, and dredging the  
16 Sacramento River to Suisun Bay. The California Debris Commission had an influential role in the  
17 history of flood management, but was terminated in 1986, and all its responsibilities were  
18 reassigned to the U.S. Army Corps of Engineers (USACE) (Kelley 1998).

19 Use of steam powered dredges began in the Delta in the 1870s and continued for many decades  
20 (Dutra 1980). The general approach was to dredge alluvial sediments in the sloughs and rivers and  
21 deposit the wet, unconsolidated material on the levee. After the dredged material dried out, it would  
22 be shaped into an overall levee cross section. Today, many levees in the central Delta still require  
23 periodic placement of new fill to meet specific design criteria to maintain flood protection.


24 The failure rate of Delta levees was generally greater in the early part of the twentieth century than  
25 during the latter half for several reasons:

- 26 The construction of upstream storage reservoirs by the mid 1960s helped attenuate flood flows  
27 into the Delta.
- 28 The construction of the two federal flood control projects significantly improved about a third of  
29 the levees in the Delta.
- 30 Some of the islands that flooded in the early part of the century were not reclaimed.  
31 Consequently, this diminished the potential number of levee failures.
- 32 The State began funding the Delta Levee Subventions and Special Projects programs in the  
33 1980s as a result of ongoing levee failures. These grant monies helped fund levee maintenance  
34 and improvements in many areas of the Delta.
- 35 More attention and resources have been given to flood fighting and responding to levee  
36 problems in the Delta.


37 In most levee failures, the breaches in the levees were repaired by either the USACE or by the local  
38 reclamation districts. Some islands were not reclaimed after flooding caused by levee failures,  
39 including:

- 40 Western Sherman Island, approximately 5,000 acres, inundated in 1878
- 41 Big Break, approximately 2,200 acres, inundated in 1927
- 42 Franks Tract, approximately 3,300 acres, inundated in 1938

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by the Water Resource Development Act of 1986 the California Debris Commission was terminated.

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"by an act of congress" the California Debris Commission was formed.

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- 1        □ Mildred Island, approximately 1,000 acres, inundated in 1983
- 2        □ Little Franks Tract, approximately 330 acres, inundated circa 1983
- 3        □ Little Mandeville Island, approximately 376 acres, inundated in 1986
- 4        □ Liberty Island, 5,209 acres, inundated in 1998

5        After the floods of 1986, the USACE stated that it would no longer reclaim flooded islands that were  
6        protected by nonproject levees (levees not authorized or constructed under a federal flood control  
7        project). In 2004, after the Jones Tract levee failure occurred, DWR repaired the breach and pumped  
8        out the floodwaters inundating the two tracts (DWR 1995). The total cost of island and damage  
9        recovery was nearly \$90 million (DWR 2008b).

10       Today, approximately 1,115 miles of levees protect 700,000 acres of land within the legal limits of  
11       the Delta, and approximately 230 miles of levees protect about 50,000 acres of the Suisun Marsh.

### 12       **6.1.3.2       Flood Management Facilities in the Central Valley and the Delta**

13       Upstream reservoirs, flood bypasses, and levees affect hydrology and flood management in the  
14       Central Valley and the Delta. Nineteen major multipurpose dams and two major flood management  
15       projects, Sacramento River Flood Control Project and the San Joaquin River Flood Control Project,  
16       reduce peak flows in the Sacramento and San Joaquin rivers and their tributaries, and the Delta. The  
17       levees built as part of these projects are designated as "project levees" and are maintained by State  
18       and local public agencies, as shown in Figure 6 7. Approximately 1,600 miles of project levees are  
19       part of the Central Valley federal flood control projects, of which 385 miles are in the Delta. The  
20       remaining levees are designated as "nonproject levees," as shown in Figure 6 7, and are maintained  
21       by local districts. Flood flows are conveyed through the Delta and into San Francisco Bay for  
22       continued conveyance through the Golden Gate to the Pacific Ocean.

23       Flood management in the Delta also involves management of seepage water from Delta channels  
24       into the islands. If left unmanaged, this seepage could flood the islands. Excess seepage is pumped  
25       from the islands into the Delta channels.

### 26       **Sacramento River Flood Control Project**

27       The Sacramento River Flood Control Project extends from the Sacramento River watershed along  
28       the Sacramento River and into the Delta and consists of the following features:

- 29       □ Approximately 980 miles of levees along the Sacramento River, extending from Collinsville to  
30       Chico Landing (at River Mile 194), and the lower reaches of the major tributaries (American,  
31       Feather, Yuba, and Bear rivers), minor tributaries, and distributary sloughs in the Delta
- 32       □ Moulton, Colusa, Tisdale, Fremont, and the Sacramento flood overflow weirs
- 33       □ Butte Basin, Sutter, and Yolo bypasses and sloughs

34       The principal features of the Sacramento River Flood Control Project extend from Ord Bend  
35       upstream of Yolo Bypass downstream to Collinsville, a distance of 184 river miles. These features  
36       include a comprehensive system of levees, overflow weirs, drainage pumping plants, and flood  
37       bypass channels (USACE 1992). The flood bypass channels, to a certain extent, mimic natural and  
38       historical flooding patterns. The project levees begin on the western bank just downstream of Stony  
39       Creek. Upstream of the levees, high flows on the river flow to the east into the Butte Basin, a trough


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Most of the levees were not built as part of the Flood Control Project but rather adopted into the system. Primarily the levees built along the bypasses were constructed as part of the flood control projects. In the Delta those levees which are located along the navigation channels are part of the flood control project.

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Butte Basin is a natural "bypass".

1 created by subsidence. The Colusa Basin Drain, a similar trough located to the west of the river,  
2 intercepts runoff from westside tributaries.

3 The Tisdale Weir is usually the first flood overflow structure to spill. When the Sacramento River  
4 reaches 23,000 cfs, flows spill over the Tisdale Weir, through the Tisdale Bypass, and into the Sutter  
5 Bypass.

6 During major flood events, the major upstream reservoirs (including Shasta, Folsom, Oroville, Black  
7 Butte, and New Bullards Bar) intercept and store initial surges of runoff and provide a means of  
8 regulating flood flow releases to streams with levees, channels, and bypass floodways. To achieve  
9 the full flood flow regulating benefits of the reservoirs, specific downstream channel capacities must  
10 be maintained. Reservoir operations are coordinated not only among various storage projects but  
11 also with downstream channel and floodway carrying capacities.

12 The Central Valley Flood Protection Board (CVFPB) agrees to maintain and hold the USACE harmless  
13 for failure of the project levees, but the CVF could not pursue the hold harmless clause unless a  
14 local public agency agrees to maintain the levees and holds the state harmless pursuant to Water  
15 Code 12642. The exceptions are described in Water Code section 12878 for state maintenance areas  
16 where the locals are assessed for the cost of the maintenance, and Water Code section 8361 which  
17 identifies units of the Sacramento Flood Control Project that DWR is required to operate and  
18 maintain (DWR 1995).

19 **Yolo Bypass**

20 The Yolo Bypass is an operative feature of the Sacramento River Flood Control Project, which was  
21 originally authorized by the Flood Control Act of 1917 and modified by various Flood Control and  
22 River and Harbor Acts in 1928, 1937, and 1941. The Yolo Bypass is located immediately west of the  
23 metropolitan area of Sacramento and lies in a general north to south orientation extending from the  
24 Fremont Weir (upstream of the Delta) downstream to Liberty Island (within the Delta), a distance of  
25 about 43 miles. The Yolo Bypass encompasses about 40,000 acres and varies in width from about  
26 7,000 feet near the Fremont Weir to about 16,000 feet at Interstate 80.


27 During high flows in the Sacramento River, water enters the Yolo Bypass via the Fremont and  
28 Sacramento weirs. Additional flows enter from the west along tributaries, including Willow Slough,  
29 Willow Slough Bypass, and Putah Creek. Waters flows from the Yolo Bypass into the Sacramento  
30 River upstream of Rio Vista. The Yolo Bypass is flooded about once every 3 years, on average, and  
31 flood flows generally occur during the winter months of December, January, and February. Local  
32 surface waters in the Yolo Bypass flow through the Tule Canal and Toe Drain, which are west of the  
33 Sacramento Deep Water Ship Channel. The USACE and the CVFPB regulate the Fremont Weir,  
34 Sacramento Weir, and the flood carrying capacity of the Yolo Bypass. DWR is responsible for  
35 maintaining and operating those portions of the Sacramento River Flood Control Project.

36 **Sacramento River Project Levees in the Delta**


37 Project levees in the northern Delta are primarily part of the Sacramento River Flood Control  
38 Project. The Sacramento River Flood Control Project was authorized by Congress in 1917 and was  
39 initially completed by USACE in 1960. The CVFPB, in conjunction with DWR and local reclamation  
40 districts, operates and maintains the project levees under an agreement with USACE (DWR 1995).

41 The Sacramento River Flood Control Project levees in the Delta include levees that protect, or  
42 partially protect, the following: West Sacramento, City of Sacramento, Walnut Grove, Courtland,

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Knights Landing Ridge Cut and Cache Creek also flow into the Yolo Bypass.

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How does the Paterno Decision effect this discussion?

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#### Surface Water

1 Clarksburg, Ryde, Hood, lands between the Sacramento River and the Sacramento River Deep Water  
2 Channel (east levee of the Deep Water Ship Channel), Merritt Island, Sutter Island, Grand Island,  
3 Ryer Island, Tyler Island, Hastings Tract, Prospect Island, Brannan Island, Twitchell Island, Pierson  
4 Tract, and Sherman Island (DWR 1993).

#### 5 **San Joaquin River Flood Control Project**

6 The San Joaquin River Flood Control System, or Project, as defined in Water Code section 12668  
7 extends from Friant Dam along the San Joaquin River to the Stockton Deep Water Ship channel, and  
8 in that area of the North Fork of the Kings River and Mendota Pool from the southerly boundary of  
9 the James Reclamation District Number 16060 to Mendota Dam.

10 Other flood control features that effect the San Joaquin River include the Chowchilla Canal and the  
11 Eastside Bypass divert upper San Joaquin River flows and intercept streams draining the central  
12 Sierra Nevada. (USACE 2002).

13 The Lower San Joaquin River Flood Control Project was authorized by Congress in 1944 and  
14 includes levees that protect, or partially protect, Stockton, Lathrop, Manteca, Tracy, Stewart Tract,  
15 Upper Roberts Island, Middle Roberts Island, Lower Roberts Island, Pescadero District, and Union  
16 Island (USACE 2008a, 1999).

#### 17 **Nonproject Levees in the Delta and Suisun Marsh**

18 Most of the levees in the Delta are nonproject levees, comprising 730 miles out of 1,115 miles. In  
19 Suisun Marsh, all of the approximately 230 miles of the levees are nonproject levees. These levees  
20 are not part of the federal flood control program and are maintained by local public reclamation  
21 districts (some are regulated by CVFPB and none are affiliated with Reclamation). Some of the  
22 maintenance activities are partially reimbursed by DWR under the Delta Levee Subventions  
23 Program established in 1973. The Delta Flood Protection Act of 1988 significantly increased  
24 reimbursement opportunities and added mitigation requirements to ensure no net long term loss of  
25 habitat. Improvement and frequent maintenance of these levees are challenging for the reclamation  
26 districts because many districts have limited funds to both maintain the levees and protect levee  
27 wildlife habitat (DWR 1995).

28 Nonproject levees also protect portions of the deep water ship channels to the two major inland  
29 ports. The Stockton Deep Water Ship Channel was built in 1933 and follows the San Joaquin River  
30 past Rough and Ready Island to the Port of Stockton via Stockton Channel. The Sacramento River  
31 Deep Water Ship Channel follows the Sacramento River and Cache Slough prior to entering the  
32 excavated deep water channel that extends to the Port of Sacramento in West Sacramento. The  
33 levees on the east sides of the Sacramento River, Cache Slough, and the Sacramento River Deep  
34 Water Ship Channel are project levees. The levees on the west side of the Sacramento River  
35 upstream of Rio Vista, west side of Cache Slough, and a portion of the west side of the excavated  
36 channel near Cache Slough are nonproject levees.

#### 37 **6.1.3.3 Operation of Water Supply and Flood Management Flow Regulation** 38 **Facilities in the Central Valley**

39 Regulated flows for a river are the downstream flows that are controlled by major storage  
40 reservoirs, dams, or irrigation diversions. Flows into the Delta vary seasonally. High inflows are

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1 typically observed from mid December until approximately mid April. The low flow season is  
 2 usually from mid April through mid December (CALFED 2000a).

3 Both the Sacramento and San Joaquin rivers have large, multipurpose dams, as summarized in Table  
 4 6.1. Most of the major dams have flood control storage capacity allocated in their reservoirs (USACE  
 5 2002a).

6 The reservoirs are operated in a manner to reduce the potential of peak flows from multiple  
 7 tributaries from reaching locations in the river systems simultaneously. The reservoirs are operated  
 8 in a coordinated manner based upon travel time from the reservoirs to the Delta. On the Sacramento  
 9 River, the travel time for flows from Shasta Dam on the Sacramento River to the Delta is about 5  
 10 days. Travel times from Oroville Dam on the Feather River and New Bullards Bar Dam on the Yuba  
 11 River to the Delta are 3 days. Travel time from Folsom Dam on the American River and New Melones  
 12 Dam on the Stanislaus River to the Delta are generally 1 to 2 days. Because of its relative proximity  
 13 to the Delta, and because the American River provides a large flow contribution, Folsom Dam's  
 14 operation also can influence on Delta flood management and can increase flows in the Sacramento  
 15 Bypass that diverts water into the Yolo Bypass.

16 Water storage in reservoirs that are operated in part for flood control purposes are reduced  
 17 gradually before the flood season begins in October and November. Reservoirs are operated  
 18 throughout the winter and spring to reduce flood potential and replenish storage toward the end of  
 19 the flood season, in March and April.

20 Seasonal Delta water quality is influenced by the amount and timing of upstream flood flows.  
 21 Freshwater flows combine with tidal inflows influence the extent of freshwater in the waterways  
 22 and saltwater in the Delta. At least three types of flood flows may occur in the Central Valley. Winter  
 23 seasonal flood flows generally affect large portions of the Central Valley from November through  
 24 April. High spring and early summer snowmelt flood flows originating from the higher elevations of  
 25 the central and southern Sierra Nevada generally occur about once every 10 years on average from  
 26 April through June. Local flood flows from strong thunderstorms with very intense rain over a  
 27 relatively small areas occur from late spring to early fall in some years.

#### 28 **6.1.4 Delta Levee Failure Risks**

29 Levee failures occur due to overtopping, through seepage, under seepage and excessive water  
 30 pressure on the levees. Excessive seepage potentially leads to creation of holes in or under the levee  
 31 that allow water to flow from the waterside to the landside of the levee (known as "piping," or  
 32 internal erosion) and boils. Boils are the water exit point on the island side of the levee when piping  
 33 occurs. The piping and/or boils can cause loss of large volumes of levee embankment or foundation  
 34 material that leads to massive levee failure.

35 No observed Delta levee failures have been directly linked to earthquake loading. However, it should  
 36 be noted that levees in the Delta area have not yet been subjected to strong earthquake loading.  
 37 Primarily because of the potential for liquefaction of levee embankments and foundations, it is  
 38 assumed that an earthquake in the area would pose a significant threat to the Delta water supply,  
 39 agriculture, and other land uses that rely on intact levees.

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This is not well written. Levees generally fail due to the following mechanisms: overtopping, seepage, erosion, instability, and seismic activity. Overtopping failure occurs when the capacity of the channel is insufficient to carry the flood flow and the water flows over the levee crown. The water flowing over the levee crown and down the landside slope erodes the levee section resulting in levee failure, this is of particular concern on levees built of sand or silt. Seepage failure is caused by water pressure within the levee or foundation large enough to cause material transport resulting in internal erosion (often characterized by boils) leading to levee failure if unchecked. Failure due to erosion is caused by either wave action perpendicular to the levee or excessive water flow velocity parallel to the levee removing sufficient material that either seepage or instability of the levee failure occurs. Instability can take multiple forms. A slip can occur due to prolonged high water resulting in weakening of the foundation and levee materials such that the driving forces are greater than resisting forces. Instability may also occur when seepage forces cause sloughing of the levee landside slope. Progressive sloughs result in a shortened seepage paths leading to levee failure. Seismic activity may result in levee failure due to liquefaction of the levee or its foundation materials, resulting in excessive deformation or undesirable transverse cracks.

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The flood control storage space is limited. Once the reservoir is full what flows into the reservoir flows out. for this reason USACE prefers the descriptor "reduction" rather than "control".



1 Table 6 1. Summary of Sacramento and San Joaquin River and Tributary Dams

Structure Name (Reservoir Name)	Stream	Type of Dam	Storage (TAF) <sup>a</sup>	Maximum Flood Control Storage (TAF) <sup>a</sup>	Owner	Year Constructed
<b>Sacramento River Basin</b>						
Shasta Dam (Shasta Lake)	Sacramento River	Gravity	4,552	1,300	Reclamation	1945
Black Butte Dam (Black Butte Lake)	Stony Creek	Earth	144	136 <sup>c</sup>	USACE	1963
New Bullards Bar Dam (New Bullards Bar Reservoir)	Yuba River	Variable Radius Arch	970	170	YCWA	1970
Oroville Dam (Lake Oroville)	Feather River	Earth	3,538	750	DWR	1968
Clear Lake <sup>d</sup> (Clear Lake)	Cache Creek	Gravity	315	0	YCFCWCD	1914
Indian Valley Dam (Indian Valley Reservoir)	North Fork Cache Creek	Earth	300	40	YCFCWCD	1976
Folsom Dam (Folsom Lake)	American River	Gravity	1,010	400 <sup>b</sup>	Reclamation	1956
Monticello Dam (Lake Berryessa)	Putah Creek	Variable Radius Arch	1,602	0	Reclamation	1957
<b>San Joaquin River Basin</b>						
Friant Dam (Millerton Lake)	San Joaquin River	Gravity	521	170 <sup>c</sup>	Reclamation	1942
Los Banos Detention Dam (Los Banos Reservoir)	Los Banos Creek	Earth	35	14	Reclamation	1965
Hidden Dam (Hensley Lake)	Fresno River	Earth	90	65	USACE	1975
Buchanan Dam (Eastman Lake)	Chowchilla River	Rockfill	150	45	USACE	1975
New Exchequer Dam (Lake McClure)	Merced River	Rockfill	1,032	350 <sup>c</sup>	Merced ID	1967
Don Pedro Dam (Don Pedro Lake)	Tuolumne River	Rockfill	2,030	340	TID	1971
New Melones Dam (New Melones Lake)	Stanislaus River	Rockfill	2,420	450	Reclamation	1979
<b>Eastside Tributaries</b>						
Pardee Dam (Pardee Reservoir)	Mokelumne River	Gravity	210	N/A <sup>e</sup>	EBMUD	1929
Camanche Dam (Camanche Reservoir)	Mokelumne River	Earth	417	200 <sup>c</sup>	EBMUD	1963
New Hogan Dam (New Hogan Reservoir)	Calaveras River	Earth	317	165	USACE	1963
Farmington Dam (Littlejohns Creek)	Littlejohns Creek	Rockfill	52	52	USACE	1951

Sources: USACE1999, 2002a

Notes: DWR = California Department of Water Resources; EBMUD = East Bay Municipal Utility District; ID = Irrigation District; N/A = not applicable; Reclamation = U.S. Bureau of Reclamation; TAF = thousand acre feet; TID = Turlock Irrigation District; USACE = U.S. Army Corps of Engineers; YCFCWCD = Yolo County Flood Control and Water Conservation District; YCWA = Yuba County Water Agency

<sup>a</sup> Storage and flood control storage values are rounded to the nearest 1,000 acre feet.

<sup>b</sup> Interim flood control storage exceeds this amount by as much as 670,000 acre feet. Storage volume varies depending on upstream storage regulation.

<sup>c</sup> Maximum flood control space may vary depending on upstream storage and/or snowpack.

<sup>d</sup> Natural lake with a dam to increase storage.

<sup>e</sup> Total flood control storage can be shared between Camanche and Pardee reservoirs. It is reported for Camanche, the downstream reservoir.

This page contains no comments

1 It is generally believed that the primary seismic hazards in the Delta consist of localized faults and  
 2 events, and thus it is unlikely that the entire Delta region will be subjected to large motions from any  
 3 single earthquake. Because of the large areal extent of the Delta and the varying distances from the  
 4 seismic sources, the Delta will experience different levels of ground shaking and potential associated  
 5 geologic hazards. In addition, the Delta is underlain by blind thrust faults that are considered active  
 6 or potentially active, but they are not expected to rupture to the ground surface. For a 100 year  
 7 return period, controlling seismic sources for Peak Ground Acceleration would include the following  
 8 fault zones: Southern Midland, Mt. Diablo, Northern Midland, Concord Green Valley, Hayward  
 9 Rodgers Creek, and Calaveras, as described in Chapter 9, Geology and Seismicity.

#### 10 **6.1.4.1 Subsidence**

11 Levee failure risks due to subsidence can be related to overall Delta subsidence, specific levee  
 12 subsidence, and/or interior island subsidence.

13 Delta subsidence is an important issue when assessing the levee system. As the landside ground  
 14 elevation decreases because of subsidence, the water level stays the same. This increase in pressure  
 15 head through the levee foundation can cause serious issues with regard to seepage, piping, and slope  
 16 stability. The theoretical volume of space between the ground surface and mean sea level within the  
 17 Delta islands is referred to as anthropogenic accommodation space and is used to measure the  
 18 effects of subsidence. The areas most susceptible to subsidence are the central, western, and  
 19 northern Delta, where thick organic peat layers predominate (PPIC 2008b).

20 Subsidence of soils beneath existing levees and settlement of the levee embankment itself are  
 21 caused by the reduction in soil volume through consolidation of soft, fine grained soil. The soil  
 22 experiences increased pressure as the embankment is constructed. Further consolidation occurs as  
 23 repairs are made and the embankment is raised, as described in Chapter 10, Soils.

24 Subsidence resulting from the biochemical oxidation of organic soils and wind disturbance is  
 25 described in Chapter 10, Soils. This process is related to the intense farming and flood control  
 26 activities within the Delta that have removed moisture from the surficial soils, which have allowed  
 27 the highly organic peat soil to react with oxygen in the air to produce carbon dioxide and aqueous  
 28 carbon (DWR 1995). This reaction allows the surficial soil to be displaced by wind. The loss of  
 29 ground surface elevation because of wind is an important issue in assessing levee stability within  
 30 the Delta. As the ground surface elevation is lowered, the landside slope of the levee becomes  
 31 steeper and less stable. The lowered ground surface also increases the hydraulic loading on the  
 32 levee and foundation.


#### 33 **6.1.4.2 Other Levee Failure Risks**

34 Other potential risks that can affect the performance of levees within the Delta include  
 35 encroachments, penetrations, excessive vegetation, burrowing animals, and security issues. These  
 36 potential risks are relatively easy to control with proper implementation of operation and  
 37 maintenance activities.


#### 38 **Encroachments**

39 Encroachments such as structures or farming practices on or close to the levee can adversely affect  
 40 the levee. Examples are excavations at or near the toe leading to increased seepage and/or  
 41 instability and obstructions on the levee crown, which can interrupt access that is important for

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Define localized.

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There are two mechanisms taking place. The island floors are subsiding due to a number of factors, primarily due to oxidation of the organic soils. The levees are settling due to consolidation of the underlying soils. The soils consolidate in response to the increased soil pressure due to the continued need to add more material to protect the levees from overtopping.

1 inspection, maintenance, and fighting floods. Another example is human intervention, such as off  
2 road vehicle use, which can reduce the integrity of the levee crown and/or slopes.

### 3 **Penetrations**

4 Penetrations of the levee, such as culverts, can directly contribute to flooding if the waterside  
5 opening does not have an appropriate closure device that seals the opening and prevents excessive  
6 seepage and subsequent instability of the levee. Because of unregulated historic construction, levees  
7 also contain many hidden risks that can cause internal erosion including: abandoned sluiceways,  
8 drainage pipes and cables, concrete loading docks, fuel tanks, and storage drums (Johnson and  
9 Pellerin 2010).

### 10 **Burrowing Animals**

11 The Delta provides an array of habitats, including marshlands, berms, and levees, for a variety of  
12 burrowing rodents. Burrows created by rodents, especially beavers, muskrats, and squirrels, can  
13 weaken the structural integrity of the levee and increase the likelihood of piping. Sunny day levee  
14 failures may result from a combination of high tide and preexisting internal levee and foundation  
15 weaknesses that may or may not be caused by burrowing animals. Rodent activities and/or  
16 preexisting weaknesses in the levees and foundations are believed to have contributed considerably  
17 to past levee failures. Reclamation districts and levee maintenance districts routinely check levees  
18 for indications of wildlife that could cause levee damage and implement removal measures followed  
19 by levee repairs if necessary (FEMA 2005, pp. 64–70).

## 20 **6.1.5 Delta Flood Risks**

21 Federal Emergency Management Agency (FEMA) and DWR have developed analytical procedures to  
22 define the probability of flooding and assess the risk of levee failures caused by flooding, as  
23 described below.

### 24 **6.1.5.1 FEMA Analyses**

25 FEMA is a primary source of present flood risk information. A key element of the program uses  
26 Flood Insurance Studies to produce Flood Insurance Rate Maps (FIRMs). Risk of flooding is defined  
27 by the probability that a flood will occur in any given year. For example, the “100 year flood” is a  
28 flood that has a 1 percent chance of occurring in any given year. This is also referred to by FEMA as a  
29 1 percent annual chance of flooding. Likewise, the “200 year flood” and “500 year flood” are floods  
30 that have a 0.5 percent and 0.2 percent chance, respectively, of occurring in any given year.

31 The FEMA flood map database is used to help establish the level of flood risk that exists at each  
32 community. FEMA's floodplains are delineated as follows:

- 33 □ Special Flood Hazard Areas (SFHA): Areas that are subject to inundation by the 1 percent annual  
34 chance flood event.
- 35 □ Other Flood Areas: Areas subject to inundation by the 0.2 percent annual chance flood or areas  
36 of 1 percent annual chance flood with average depths less than 1 foot or with drainage areas less  
37 than 1 square mile.
- 38 □ Other Areas: Areas determined to be outside the 0.2 percent annual chance floodplain.

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1 FEMA does not delineate floodplains for floods smaller than 1 percent annual chance floods,  
2 meaning floods that occur more frequently, such as 2 and 10 percent annual chance (50 and 10  
3 year) floods. The SFHAs shown on these maps include areas described as "A" zones. Zone A means  
4 that flood elevations have not been determined for the area. Areas not in the "A" zones generally are  
5 less likely to flood because of ground elevation or protection by a certified levee or other protective  
6 feature.

7 In 2003, FEMA initiated a nationwide FIRM Modernization Project (FEMA 2010a). This project  
8 includes a strict review of levees protecting low lying areas to ensure that they meet FEMA criteria  
9 for mapping a protected area as not being in a SFHA (i.e., not subject to inundation by a 1 percent  
10 annual chance flood).

11 Most areas of the Delta that were previously indicated as having 100 year protection (and therefore  
12 not included in SFHAs) are now having difficulty proving that their levees are adequate. Some areas,  
13 including West Sacramento and Reclamation District 17 in Lathrop, are initiating upgrade projects.  
14 Revised FEMA maps are planned to be issued over the next several years.

15 The Delta spans numerous FIRM panels and contains several FEMA flood zones. Encroachments  
16 within these flood zones are subject to Federal, State, and local regulatory requirements. The  
17 Federal regulatory requirements represent the minimum level of compliance needed. The local and  
18 State requirements may be more stringent. Existing FEMA flood zones within the Delta are broken  
19 into several groups: Special Flood Hazard Areas, Floodway Areas, Other Flood Areas, and Other  
20 Areas. The flood zones that exist within the Delta are described below.

21 ■ Special Flood Hazard Areas Special Flood Hazard Areas are subject to inundation by the 1  
22 percent annual chance flood, or base flood. The following flood zones are Special Flood Hazard  
23 Areas that are present in the Delta:

24 ■ Zone A refers to areas where the water surface elevations have not been determined for the  
25 base flood. No detailed studies were conducted for Zone A areas, and the boundaries are  
26 approximate. No floodways exist within Zone A boundaries. A significant portion of the Delta  
27 has been mapped as Zone A. The Zone A areas are primarily located near the boundaries of  
28 the legal limits of the Delta. The following RDs are mostly or entirely mapped as Zone A:  
29 2068, 2104, 2060, 1667, 501, 1614, 828, 404, 2089, and 2117. A few small areas outside of  
30 these RDs are within the Delta boundaries and have been mapped as Zone A, as shown in  
31 Figure 6 9.

32 ■ Zone AE characterizes Special Flood Hazard Areas where base floodwater surface elevations  
33 have been established. Floodway Areas in Zone AE are defined as the channel of a stream  
34 plus any adjacent floodplain areas. These areas must be kept free of encroachment so that  
35 the 1 percent annual chance flood can be carried without substantial increases in flood  
36 heights. A vast majority of the Delta is mapped as Zone AE. The areas mapped as Zone AE  
37 are primarily located in the central area of the Delta, but Zone AE areas encompass a greater  
38 part of all regions of the Delta. Virtually all of the primary zone of the Delta, with the  
39 exception of RDs 744, 755, 551, and 554, is mapped as Zone AE, as shown in Figure 6 9.

40 ■ Zone AH represents Special Flood Hazard Areas where base flood elevations have been  
41 determined and the depth of water is between 1 and 3 feet. Only a small region of the Delta  
42 has been mapped as Zone AH. The zone covers the portion of the City of Thornton that is  
43 east of North Nowell Road, as shown in Figure 6 9. The City of Thornton is part of RD 348,

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- 1 which is located between the eastern boundary of the primary zone and the eastern legal
- 2 limit of the Delta.
- 3 ☐ Other Flood Areas Other Flood Areas are areas of 0.2 percent annual chance flood, areas of 1
- 4 percent annual chance flood with average depths of less than 1 foot or with drainage areas less
- 5 than 1 square mile, and areas protected by levees from the 1 percent annual chance flood:
- 6 ☐ Shaded Zone X areas represent the areas that fulfill the criteria in place for "Other Flood
- 7 Areas." Generally, Shaded Zone X areas are those areas that are within the 0.2 percent
- 8 annual chance floodplain, and either outside or protected from a 1 percent annual chance
- 9 flood. This is shown on the FEMA flood zone map, shown in Figure 6-9 as "0.2 percent
- 10 annual chance of flooding."
- 11 ☐ Other Areas Other Areas consist of two flood zones: Un Shaded Zone X, Zone D, and Zone V/VE:
- 12 ☐ Un Shaded Zone X areas are those areas that are determined to be outside the 0.2 percent
- 13 annual chance floodplain. A substantial portion of the Delta has been mapped as Un Shaded
- 14 Zone X. Un Shaded Zone X areas include the following cities: Tracy in the southern Delta;
- 15 Oakley, Antioch, and Pittsburg in the western Delta; and Stockton in the eastern Delta, as
- 16 shown in Figure 6-9.
- 17 ☐ Zone D areas may contain flood hazards that have not been determined. These areas are
- 18 located near Suisun Bay and Suisun Marsh, as shown in Figure 6-9.
- 19 ☐ Zone VE areas are coastal related flood zones that occur in Suisun Marsh, as shown in Figure
- 20 6-9.

#### 21 **6.1.5.2 FEMA Flood Areas**

- 22 The following descriptions of communities in the Delta and Suisun Marsh area are based on existing
- 23 FEMA maps, which show floodplain delineations for areas subject to 1 percent annual chance floods:
- 24 Antioch. The City of Antioch is located within Contra Costa County and adjacent to the San
- 25 Joaquin River. The City of Antioch is mapped into the 1 percent annual chance floodplain from
- 26 the San Joaquin River and its tributaries (FEMA FIRM Maps 06013C: 0139F, 0143F, 0144F dated
- 27 June 16, 2009).
- 28 ☐ Benicia. The City of Benicia is located in Solano County and adjacent to the Suisun Bay. Flooding
- 29 from the Suisun Bay accounts for a portion of the 1 percent annual chance floodplain (Zone AE)
- 30 mapped in Benicia (FEMA FIRM Maps 06095C: 0635E, 0633E, 0634E, 0642E, 0653E, and 0675E
- 31 dated June 16, 2009).
- 32 ☐ Clarksburg. Clarksburg is an unincorporated community located on the western bank of the
- 33 Sacramento River in Yolo County. Clarksburg does not have official boundaries, but it is situated
- 34 to the north of the confluence of Elk Slough and the Sacramento River and south of Winchester
- 35 Lake. Clarksburg is located within a 1 percent annual chance floodplain (Zone A). Levees are
- 36 located along the Sacramento River and Elk Slough but not along Winchester Lake. These levees
- 37 are shown as not providing protection from the 1 percent annual chance flood (FEMA FIRM Map
- 38 06113C0745G dated June 16, 2010).
- 39 ☐ Courtland. Courtland is an unincorporated community located on the eastern bank of the
- 40 Sacramento River in Sacramento County. Courtland is located in the Pierson District, which is
- 41 bordered by the Sacramento River to the west and north, Snodgrass Slough to the east, and

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- 1 Meadows Slough to the south. Courtland is protected from the 1 percent annual chance flood by
- 2 levees along the Sacramento River, Snodgrass Slough, and Meadows Slough, and is not mapped
- 3 in a 1 percent annual chance floodplain (0602620005C dated September 30, 1988 and
- 4 0602620010D dated February 4, 1998).
- 5 Lathrop. The City of Lathrop is divided by the San Joaquin River into two distinct land use
- 6 sections: highly developed lands in the east and agricultural lands in the west. The area west of
- 7 the San Joaquin River is subject to flooding by the 1 percent annual chance flood. However, the
- 8 lands to the east are protected from the 1 percent annual chance flood by a levee along the
- 9 eastern bank of the San Joaquin River, so this area is not mapped in a 1 percent annual chance
- 10 floodplain. This levee is considered a Provisionally Accredited Levee (PAL), and levee owners or
- 11 communities are required to submit the data necessary to comply with 44 CFR 65.10; otherwise,
- 12 the levee can be de accredited (FEMA FIRM Maps: 06077C: 0585F, 0595F, 0605F, 0610F, 0615F,
- 13 and 0610F dated October 16, 2009).
- 14 Locke. Locke is an unincorporated community located on the eastern bank of the Sacramento
- 15 River in Sacramento County. Locke does not have any official boundaries, but its general area is
- 16 mapped in a 1 percent annual chance floodplain. Levees around Locke line the Sacramento River
- 17 on the west, the Delta Cross Channel to the south, and Snodgrass Slough to the east, but do not
- 18 protect it from the 1 percent annual chance flood (FEMA FIRM Map 0602620560C, dated
- 19 September 30, 1988; Map 0602620420D, dated February 4, 1998).
- 20 Manteca (western portion). The City of Manteca is located to southeast of the City of Lathrop
- 21 adjacent to the San Joaquin River. A portion of Manteca is protected from the 1 percent annual
- 22 chance flood (from the San Joaquin River) by the Western Ranch South Levee, which is
- 23 considered a PAL (see discussion for Lathrop); this area is not mapped in 1 percent annual
- 24 chance floodplain. South of the Western Ranch South Levee, a relatively small portion of the city
- 25 is mapped in the 1 percent floodplain (FEMA FIRM Map 06077C0620F dated October 16, 2009).
- 26 Oakley. The City of Oakley is located in Contra Costa County east of the City of Antioch and
- 27 located adjacent to San Joaquin River, Big Break, and Dutch Slough. This city is mapped in the 1
- 28 percent annual chance floodplain from the San Joaquin River and its tributaries (FEMA FIRM
- 29 Maps 06013C: 0165F, 0170F, 0355F, and 0360F dated June 16, 2009).
- 30 Pittsburg. The City of Pittsburg is located in Contra Costa County and located adjacent to San
- 31 Joaquin River and Suisun Bay. This city is mapped in the 1 percent annual chance floodplain
- 32 from the Suisun Bay. Flooding sources also include the San Joaquin River (FEMA FIRM Maps
- 33 06013C: 0118F, 0119F, 0120F, and 0139F dated June 16, 2009).
- 34 Rio Vista. The City of Rio Vista is drained east southeasterly by Marina Creek, Marina Creek
- 35 Tributary, and Industrial Creek as they flow toward the Sacramento River. The portion of the
- 36 city west of the Sacramento River is subject to the 1 percent annual chance flood (mapped in the
- 37 1 percent annual chance floodplain) because of flooding from the Watson Hollow and Cache
- 38 Slough. The lower reaches of the Sacramento River are under the influence of tides. Severe
- 39 flooding along this waterway could result when very high tides and a large volume of stream
- 40 outflow occur coincidentally, and strong onshore winds generate wave action that would
- 41 increase the flood hazard above that of the tidal surge alone (FEMA FIRM Maps 06095C: 0530E,
- 42 0424E, 0537E, 0541E, and 0539E dated May 4, 2009).
- 43 Sacramento (Pocket Area). The City of Sacramento's Pocket Area is located in the southern
- 44 portion of the community. This community is bordered by Interstate 5 to the east and the

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1 Sacramento River to the south, west, and north. A levee located along the Sacramento River is  
2 shown as providing protection from the 1 percent annual chance flood; however, this levee is  
3 shown as a PAL; this area is not mapped in the 1 percent annual chance floodplain  
4 (0602660285G and 0602660305G dated December 8, 2008).

5 □ Stockton (western portion). The City of Stockton is situated adjacent to a network of sloughs and  
6 canals that branch off the San Joaquin River. The western region of Stockton is protected from  
7 the 1 percent annual chance flood by levees along Bear Creek, Lower Mosher Creek, Fourteen  
8 Mile Slough, Five Mile Slough, Disappointment Slough, Calaveras River, Smith Canal, Stockton  
9 Deep Water Ship Channel, Burns Cutoff, and the San Joaquin River. Each of these levees is  
10 considered a PAL (see discussion for Lathrop); this area is not mapped in a 1 percent annual  
11 chance floodplain (FEMA FIRM Maps: 06077C: 0295F, 02315F, 0320F, 0435F, 0455F, 0460F,  
12 0465F, and 0470F dated October 16, 2009).

13 □ Walnut Grove. Walnut Grove is an unincorporated community located on the eastern bank of the  
14 Sacramento River in the northern part of Tyler Island. It is protected from the 1 percent annual  
15 chance (100 year) flood by levees that line the Delta Cross Channel to the north and along the  
16 Mokelumne River to the south. This community is not mapped in a 1 percent annual chance  
17 floodplain.

18 □ West Sacramento. The City of West Sacramento is currently designated as being protected from  
19 the 0.2 percent annual chance flood by levees that line the western bank of the Sacramento  
20 River (FEMA FIRM Maps 0607280005B and 0607280010B, dated January 19, 1995). However,  
21 FEMA is in the process of de accrediting the city's levees. The northeastern portion of the city is  
22 close to the confluence of the American and Sacramento rivers, which is a FEMA designated  
23 floodway. Levees are also located along the Yolo Bypass, Sacramento River Deep Water Ship  
24 Channel, and Sacramento Bypass.

25 FEMA maps indicate that much of the central Delta, essentially all of the non urban Delta, is within  
26 SFHAs (mapped in the 1 percent annual chance floodplain) and considered to be subject to  
27 inundation by the 1 percent annual chance flood. The urban areas at the edges of the Delta (West  
28 Sacramento, Sacramento, Stockton, Mossdale, etc.) are working to preserve their levee accreditation  
29 and thereby avoid being designated as "A" zones.

### 30 **6.1.5.3 DWR State Plan of Flood Control**

31 DWR recently completed a "Public Draft 2012 Central Valley Flood Protection Plan" (State Plan of  
32 Flood Control) (DWR 2011) for consideration by the Central Valley Flood Protection Board. The  
33 report analyzes current and future flood risks and recommends an investment approach to improve  
34 public safety, ecosystem conditions, and economic sustainability. The State Plan of Flood Control  
35 addresses the Sacramento River Flood Control Project facilities and other project levees to which  
36 DWR or the Central Valley Flood Protection Board cooperates with the federal government for  
37 operations and maintenance. The report included a summary of levee conditions for the levees  
38 evaluated in the report. The report indicated that about 50% of the 300 miles of urban levees  
39 evaluated do not meet engineering design criteria for projected design water surface elevations  
40 based on criteria published in "Design and Construction of Levees Engineering Manual 1110 2  
41 1913" (USACE, 2000) and "Interim Levee Design Criteria for Urban and Urbanizing Areas in the  
42 Sacramento Valley, Version 4" (DWR 2010c). The report also indicated that about 60% of the 1,230  
43 miles of non urban levees considered have a high potential for failure for projected design water  
44 surface elevations based upon an analysis that correlated geotechnical data with levee performance

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1 history but not relative to specific design criteria. The report further described that about 50% of  
2 the 1,016 miles of channels evaluated had potentially inadequate capacity to convey design flows;  
3 none of the 32 hydraulic structures and 11 pumping plants inspected were rated "unacceptable,"  
4 many were approaching the end of their design life; and 2 of the 10 bridges that were inspected  
5 required repairs (DWR 2011). This analysis only applies to the Project Levees in the Delta.

## 6 **6.2 Regulatory Setting**

7 This section provides the regulatory setting for surface water resources, including potentially  
8 relevant federal, state, and local requirements applicable to the BDCP.

9 Federal regulations that address water quality also may apply to surface water quality, as presented  
10 in Chapter 8, Water Quality, and Chapter 10, Soils. These regulations are federally mandated and  
11 implemented in California through the State Water Resources Control Board. State regulations that  
12 address water quality also may apply to surface water quality, including the and Order No.  
13 99 08 DWQ, NPDES General Permit No. CAS000002, WDRs for Discharges of Stormwater Runoff  
14 Associated with Construction Permit (General Permit) as presented in Chapter 8, Water Quality, and  
15 Chapter 10, Soils.

### 16 **6.2.1 Federal Plans, Policies, and Regulations**

17 The following Federal regulations may apply to surface water, but are presented in other sections:

- 18 ☐ Safe Drinking Water Act (42 USC 300f) – see Chapter 8, Water Quality
- 19 ☐ Clean Water Act (33 USC 1251–1376) – see Chapter 8, Water Quality and Chapter 9, Soils.
- 20 ☐ Central Valley Project Improvement Act (PL 102 575) – see Chapter 5, Water Supply.
- 21 ☐ Coordinated Operations Agreement – see Chapter 5, Water Supply.
- 22 ☐ Trinity River Mainstem Fishery Restoration (per Central Valley Project Improvement Act) – see
- 23 Chapter 5, Water Supply.
- 24 ☐ San Joaquin River Agreement – see Chapter 5, Water Supply.
- 25 ☐ National Marine Fisheries Service and U.S. Fish and Wildlife Service Biological Opinions – see
- 26 Chapter 5, Water Supply.
- 27 ☐ Federal Power Act – see Chapter 5, Water Supply.

28 Other Federal plans, policies, and regulations that could affect surface waters are related to  
29 management of floodplains.

#### 30 **6.2.1.1 1850 Swamp and Overflowed Lands Act**

31 In 1849, Congress granted Louisiana certain wetlands described as "swamp and overflowed lands,  
32 which may be or are found unfit for cultivation" in order to facilitate land reclamation and the  
33 control of flooding. On September 28, 1850, Congress passed a subsequent Swamp and Overflowed  
34 Lands Act to convey similar public lands to twelve other states with no cost. This act, sometimes  
35 referred to as the Arkansas Act, also applied to California. The only requirement of the act was that  
36 the states use the funds they realized from the sale of these lands to ensure that they would be

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1 drained, reclaimed, and put to productive agricultural uses. The State of California received  
2 2,192,506 acres of land, which included 549,540 acres in the Sacramento Valley and approximately  
3 500,000 acres in the Sacramento San Joaquin Delta.

#### 4 **6.2.1.2 Federal Emergency Management Agency**

5 FEMA is responsible for maintaining minimum Federal standards for floodplain management within  
6 the United States and territories of the United States. As discussed below, FEMA plays a major role in  
7 managing and regulating floodplains. FEMA is responsible for management of floodplain areas,  
8 which are defined as the lowland and relatively flat areas adjoining inland and coastal waters  
9 subject to a 1 percent or greater chance of flooding in any given year (the 100 year floodplain).

#### 10 **Executive Order 11988, Floodplain Management**

11 Under Executive Order 11988, all Federal agencies are charged with floodplain management  
12 responsibilities when planning or designing Federally funded projects or when considering any  
13 permit applications for which a Federal agency has review and approval authority. These  
14 responsibilities include taking action to reduce the risks of flood losses, including adverse impacts to  
15 human safety, health, and welfare. Federal agencies also are charged with the responsibility of  
16 restoring the natural and beneficial values of floodplains. If a proposed action is located within a  
17 floodplain, measures should be identified to minimize flood hazards, and floodplain mitigation  
18 requirements should be incorporated into the proposed action (FEMA 1982).

#### 19 **National Flood Insurance Program**

20 FEMA administers the National Flood Insurance Program (NFIP). The NFIP has two main  
21 components: floodplain management assistance and flood insurance assistance. The purpose of  
22 flood insurance is to enable property owners to purchase insurance against losses from physical  
23 damage or the loss of buildings and their contents caused by floods, flood related mudslides, or  
24 erosion. Insurance is available to property owners belonging to NFIP participating communities.  
25 The NFIP is administered by the Federal Insurance Administration under FEMA. Participation in the  
26 NFIP also makes communities eligible for Federal flood disaster assistance. For a community to be  
27 eligible to participate in the NFIP, the community must adopt a local floodplain management  
28 ordinance that meets or exceeds the minimum Federal standards defined in 44 CFR 60-65.  
29 Participating communities must adhere to all floodplain management requirements, with oversight  
30 from FEMA, for all activities that may affect floodplains within the Special Flood Hazard Areas.

31 As part of the NFIP, FEMA provides one or more FIRMs (discussed previously in the Floodplain  
32 Delineation section). Each FIRM contains flood zones that are used to determine a community's  
33 flood insurance rates and floodplain development restrictions. It identifies which communities are  
34 Federally required to carry flood insurance. For example, communities can choose to participate or  
35 not participate in the NFIP. Homeowners with Federally backed mortgages may be required to carry  
36 flood insurance, but otherwise may not be required to carry insurance. Flood zones are areas  
37 delineated to represent areas with similar flood risk, flood protection infrastructure, flood  
38 protection infrastructure certifications, and designated floodways. FEMA requires that local  
39 governments covered by Federal flood insurance pass and enforce a floodplain management  
40 ordinance that specifies minimum requirements for any construction within the 100 year  
41 floodplain.

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## **Flood Zone Regulations**

Special Flood Hazard Areas are subject to Federal and State requirements, which are defined primarily by federal regulations at 44 CFR 60.3 and 44 CFR 65.12. The first citation requires the following:

- (6) Notify, in riverine situations, adjacent communities and the State Coordinating Office prior to any alteration or relocation of a watercourse, and submit copies of such notifications to the Administrator;
- (7) Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained;
- (10) Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community [44 CFR 60.3(b)(6,7,10)].

These Federal regulations are intended to address the need for effective floodplain management and provide assurance that the cumulative effects of floodplain encroachment do not cause more than a 1 foot rise in water surface elevation after the floodplain has been identified on the FIRM (local flood ordinances can set a more stringent standard). The absence of a detailed study or floodway delineation places the burden on the project proponent to perform an appropriate engineering analysis to prepare hydrologic and hydraulic analyses consistent with FEMA standards. These analyses would then be used to evaluate the proposed project together "with all other existing and anticipated development." Defining future anticipated development is difficult. The purpose of this requirement is to avoid inequitable encroachments into the floodplain.

For projects that are discovered to cause any increase in water surface elevations, 44 CFR 65.12, "Revision of flood insurance rate maps to reflect base flood elevations caused by proposed encroachments," states:

- (a) When a community proposes to permit encroachments upon the flood plain when a regulatory floodway has not been adopted or to permit encroachments upon an adopted regulatory floodway which will cause base flood elevation increases in excess of those permitted under paragraphs (c)(10) or (d)(3) of § 60.3 of this subchapter, the community shall apply to the Administrator for conditional approval of such action prior to permitting the encroachments to occur and shall submit the following as part of its application:
  - (1) A for conditional approval of map change and the appropriate initial fee as specified by § 72.3 of this subchapter or a request for exemption from fees as specified by § 72.5 of this subchapter, whichever is appropriate;
  - (2) An evaluation of alternatives which would not result in a base flood elevation increase above that permitted under paragraphs (c)(10) or (d)(3) of § 60.3 of this subchapter demonstrating why these alternatives are not feasible;
  - (3) Documentation of individual legal notice to all impacted property owners within and outside of the community, explaining the impact of the proposed action on their property;
  - (4) Concurrence of the Chief Executive Officer of any other communities impacted by the proposed actions;
  - (5) Certification that no structures are located in areas which would be impacted by the increased base flood elevation;

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- 1 (6) A request for revision of base flood elevation determination according to the provisions of §  
2 65.6 of this part;
- 3 (7) A request for request floodway revision in accordance with the provisions of § 65.7 of this  
4 part.

5 The provisions of this regulation require either demonstration that the proposed project would  
6 cause no effect on the base flood elevations or else the project must obtain a Conditional Letter of  
7 Map Revision prior to permitting the project for construction. Also, as suggested, if the project  
8 causes no effect on the base flood elevations, it can be approved by the floodplain administrator for  
9 the community without any approvals by FEMA or Conditional Letter of Map Revision submittals to  
10 FEMA. However, the floodplain administrator can require a Conditional Letter of Map Revision if it is  
11 felt that the project is of sufficient complexity to warrant FEMA's review.

12 The minimum Federal regulatory requirement pertaining to encroachments into the floodway is  
13 defined by 44 CFR 60.3(d)(3):

- 14 (3) Prohibit encroachments, including fill, new construction, substantial improvements, and  
15 other development within the adopted regulatory floodway unless it has been demonstrated  
16 through hydrologic and hydraulic analyses performed in accordance with standard  
17 engineering practice that the proposed encroachment would not result in any increase in  
18 flood levels within the community during the occurrence of the base flood discharge.

19 This regulation applies only to encroachments into the floodway. When there is such an  
20 encroachment, the FEMA effective hydraulic model should be used to evaluate the impacts and  
21 mitigation options for the encroachment.

## 22 **FEMA Levee Design and Maintenance Regulations**

### 23 **Code of Federal Regulations**

24 Guidance and criteria for levees included in the NFIP are provided in 44 CFR 65.10. The major  
25 criteria within the document include freeboard, closure structures, embankment protection,  
26 embankment and foundation stability, settlement, interior drainage, and other design criteria.  
27 Operation and maintenance requirements are also discussed. Each of these criteria includes specific  
28 design guidelines that must be met in order for the levee to remain in the NFIP. It should be noted  
29 that FEMA is not responsible for evaluating these levees; the evaluation is performed by others,  
30 which leads to FEMA accreditation when FEMA adopts the certification.

### 31 **Procedure Memorandum 34**

32 Procedural Memoranda supplement and clarify the information in Appendix H of FEMA's Guidelines  
33 and Specifications for Flood Hazard Mapping Partners (2003) regarding mapping the base flood in  
34 areas with levees. Procedural Memorandum 34, Interim Guidance for Studies Including Levees,  
35 provides FEMA staff, contractors, and mapping partners with guidance for the evaluation and  
36 mapping of levees and levee affected areas as part of the FEMA Flood Map Modernization Program  
37 (FEMA 2010b).

### 38 **Procedure Memorandum 43**

39 Procedural Memorandum 43, Guidelines for Identifying Provisionally Accredited Levees, provides  
40 FEMA staff, contractors, and mapping partners with guidance for identifying Provisionally

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1 Accredited Levees and mapping levee affected areas. Also included is a fact sheet, prepared in  
2 question and answer format, that provides detailed information regarding NFIP procedures for  
3 evaluating and mapping levee systems with emphasis on Procedural Memorandum 43 and  
4 Provisionally Accredited Levee systems. This fact sheet was designed for a more technical audience.  
5 Additional documents include flow charts and sample letters for different levee scenarios (National  
6 Committee on Levee Safety 2009).

#### 7 **Hazard Mitigation Plan Criteria**

8 Guidance regarding Hazard Mitigation Plans for both State and local agencies is provided in 44  
9 CFR 201. Hazard Mitigation Plans are necessary for receiving grant funding under the Stafford Act  
10 for prevention planning. The States must demonstrate a commitment to risk reduction from natural  
11 hazards, including levee failure. Hazard Mitigation Plans act as guidance for State decision makers in  
12 determining the appropriation of resources to the reduction of these risks.

13 In California, the Hazard Mitigation Plan design standards (based upon geometric criteria for the  
14 levees) were negotiated by the FEMA, DWR, California Office of Emergency Services, and the Delta  
15 Levee Maintaining Agencies between 1983 and 1987 to establish a minimal, short term interim  
16 standard to reduce the risk of repeat flood damage. Although this standard was to be an interim  
17 standard, no adjustments based on subsequent or projected flood elevations have been used to  
18 modify the standard. Meeting this standard allows the Delta island or tract to be eligible for FEMA  
19 disaster grants and assistance following levee failures and island inundation. If even a portion of the  
20 levee around the island or tract does not meet the Hazard Mitigation Plan standard, the FEMA will  
21 deny claims for levee damage.

#### 22 **FEMA 100 year (Base Flood) Protection**

23 The FEMA 100 year Protection standard, often called the 1 percent annual chance flood level of  
24 protection, is based on criteria established in the Code of Federal Regulations and is often used with  
25 established USACE criteria to meet certain freeboard, slope stability, seepage/underseepage,  
26 erosion, and settlement requirements. Numerical hydrologic models are used to project surface  
27 water elevations at different locations in the rivers for the statistically probable 100 year flood  
28 event. Model runs are updated periodically to reflect changes in river bathymetry and historical  
29 hydrology. Meeting this level of flood protection means that communities will not require  
30 mandatory purchase of flood insurance for houses in the floodplain or be subject to building  
31 restrictions. This standard generally does not address seismic stability. Currently, FEMA 100 year  
32 criteria are based on historical conditions and do not include considerations for climate change or  
33 sea level rise. FEMA is currently completing a study on the Impact of Climate Change on the National  
34 Flood Insurance Program (FEMA 2010c) to determine how to accommodate these factors and the  
35 long term implications.

#### 36 **FEMA Levee Design and Maintenance Requirements**

37 For levees to be accredited by FEMA, and to allow communities to participate in Preferred Risk  
38 programs of the NFIP, evidence must be provided that adequate design, operation, and maintenance  
39 systems are in place to provide reasonable assurance that protection from the base flood (1 percent  
40 annual chance of exceedance or 100 year flood) exists. These requirements are outlined in 44 CFR,  
41 Volume 1, Chapter I, Part 65.10 and summarized as follows:

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#### Surface Water

- 1        □ Freeboard. Riverine levees must provide a minimum freeboard of 3 feet above the water surface
- 2        level of the base flood. An additional 1 foot above the minimum is required within 100 feet on
- 3        either side of structures (such as bridges) riverward of the levee or whatever the flow is
- 4        constructed. An additional 0.5 foot above the minimum at the upstream end of the levee,
- 5        tapering to not less than the minimum at the downstream end of the levee, is also required.
- 6        □ Closure. All openings must be provided with closure devices that are structural parts of the
- 7        system during operation and designed according to sound engineering practice.
- 8        □ Embankment protection. Engineering analyses must be submitted demonstrating that no
- 9        appreciable erosion of the levee embankment can be expected during the base flood as a result
- 10       of either currents or waves, and that anticipated erosions will not result in failure of the levee
- 11       embankment or foundation directly or indirectly through reduction of the seepage path and
- 12       subsequent instability.
- 13       □ Embankment and foundation stability. Engineering analyses that evaluate levee embankment
- 14       stability must be submitted. The analyses provided shall evaluate expected seepage during
- 15       loading conditions associated with the base flood and shall demonstrate that seepage into or
- 16       through the levee foundation and embankment will not jeopardize embankment or foundation
- 17       stability.
- 18       □ Settlement. Engineering analyses must be submitted that assess the potential and magnitude of
- 19       future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be
- 20       maintained within the minimum standards.
- 21       □ Interior drainage. Analysis must be submitted that identifies the source(s) of such flooding, the
- 22       extent of the flooded area, and, if the average depth is greater than 1 foot, the water surface
- 23       elevation(s) of the base flood.
- 24       □ Operation plans. For a levee system to be recognized, a formal plan of operation must be
- 25       provided to FEMA. All closure devices or mechanical systems for internal drainage, whether
- 26       manual or automatic, must be operated in accordance with an officially adopted operational
- 27       manual, a copy of which must be provided to FEMA.
- 28       □ Maintenance Plans. Levee systems must be maintained according to an officially adopted
- 29       maintenance plan. All maintenance activities must be under the jurisdiction of a federal or State
- 30       agency, an agency created by the federal or State law, or an agency of a community participating
- 31       in the NFIP that must assume ultimate responsibility for maintenance. The plan must document
- 32       the formal procedure that ensures that the stability, height, and overall integrity of the levee and
- 33       its associated structures and system are maintained. At a minimum, maintenance plans shall
- 34       specify the maintenance activities to be performed, the frequency of their performance, and the
- 35       person, by name or by title, responsible for their performance.
- 36       The information submitted to support that the levee complies with the above requirements must be
- 37       certified by a registered professional engineer. Certified as built plans of the levee also must be
- 38       submitted.

### 39       **6.2.1.3       U.S. Army Corps of Engineers**

- 40       The following discussion provides an overview of USACE's regulatory responsibilities that apply to
- 41       navigable waters and construction within the ordinary high water mark of other waters of the
- 42       United States. In addition, USACE constructs flood control and risk management projects and

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1 monitors their operations and maintenance. It also provides emergency response to floods. These  
2 functions are also described below.

### 3 **Flood Control Act of 1936**

4 USACE constructs local flood control and risk management projects and navigation projects in the  
5 Delta. The Flood Control Act of 1936 established a nationwide policy that flood control on navigable  
6 waters or their tributaries is in the interest of the general public welfare and is, therefore, a proper  
7 activity of the Federal government in cooperation with States and local entities. The 1936 Act, its  
8 amendments, and subsequent legislation specify details of Federal participation. Projects are either  
9 specifically authorized through legislation by Congress or through a small projects blanket  
10 authority. Typically, a feasibility study is done to determine Federal interest before authorization or  
11 construction. USACE has a Delta feasibility study underway. A study under the American River  
12 Common Features authority is studying additional flood protection for the City of Sacramento that  
13 could involve alteration to Sacramento River levees or the Yolo Bypass in the Delta. The planned San  
14 Joaquin River basin study will evaluate more flood protection for the City of Stockton and vicinity.  
15 The West Sacramento Feasibility Study is evaluating flood protection for the City of West  
16 Sacramento.

### 17 **U.S. Army Corps of Engineers Navigation Projects**

18 Federal interest in navigation is established by the Commerce Clause of the Constitution and court  
19 decisions defining the right to improve and protect navigable waterways in the public's interest.  
20 USACE navigation projects in the Delta include Suisun Bay Channel, Sacramento River Deep Water  
21 Ship Channel, and Stockton Deep Water Ship Channel. Associated with navigation is the Long Term  
22 Management Strategy for Delta Sediments. This is a plan to coordinate and manage dredging for  
23 navigation, flood risk management, water conveyance, and recreation; stabilize levees; and protect  
24 ecosystems. Technical work groups are engaged in pilot studies, preparing orders and permits for  
25 dredging and beneficial reuse and compliance with environmental laws. The Suisun Channel in the  
26 Suisun Marsh is a USACE navigation project to maintain a navigable connection between the City of  
27 Suisun and Grizzly Bay (USACE 2006; USACE Website 2010).

### 28 **U.S. Army Corps of Engineers Responsibility Under Clean Water Act**

29 The Clean Water Act established the basic structure for regulating discharges of pollutants into  
30 waters of the United States and gave the U.S. Environmental Protection Agency the authority to  
31 implement pollution control programs such as setting wastewater standards for industry. The Clean  
32 Water Act sets water quality standards for all contaminants in surface waters and allows the U.S.  
33 Environmental Protection Agency to delegate some of its authority for enforcing such standards to  
34 states (the California State Water Resources Control Board is the agency that helps enforce water  
35 quality standards in California). The law employs a variety of regulatory and non regulatory tools to  
36 reduce direct pollutant discharges into waterways, finance municipal wastewater treatment  
37 facilities, and manage polluted runoff.


38 Section 404 of the Clean Water Act establishes programs to regulate the discharge of dredged and  
39 fill material into waters of the United States, including wetlands. Activities in waters of the United  
40 States that are regulated under this program include fills for development, water resource projects  
41 (e.g., dams and levees), infrastructure development (e.g., highways and airports), and conversion of  
42 wetlands to uplands for farming and forestry. Under Section 404, any person or public agency

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The USACE also has a shallow draft navigation responsibility on the Sacramento and Feather Rivers. Contact Gary Kamei at (916) 557-6845 for more details.

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The USACE is also engaged in design and construction of South Sacramento Streams which is also partially in the Legal Delta boundary. Contact Marshall Marik at (916)557-7698 for more details.

1 proposing to locate a structure, excavate, or discharge dredged or fill material into waters of the  
2 United States or to transport dredged material for the purpose of dumping it into ocean waters must  
3 obtain a permit from USACE. USACE has jurisdiction over all waters of the United States including,  
4 but not limited to, perennial and intermittent streams, lakes, ponds, as well as wetlands in marshes,  
5 wet meadows, and side hill seeps. Clean Water Act Section 404(b)(1) guidelines provide  
6 environmental criteria and other guidance used in evaluating proposed discharges of dredged  
7 materials into waters of the United States. For proposed discharges of dredged material to comply  
8 with the guidelines, they must satisfy four requirements found in Section 230.10. Among these  
9 requirements are that those discharges of dredged material do not result in significant degradation  
10 of the aquatic ecosystem and that all practicable means be used to minimize adverse environmental  
11 impacts.

12 Under Section 401 of the Clean Water Act, every applicant for a Federal permit or license for any  
13 activity that may result in a discharge to a water body must obtain State certification that the  
14 proposed activity will comply with State water quality standards (City of Stockton 2005).

### 15 **Rivers and Harbors Act of 1899**

16 33 United States Code 408 and Section 14 of the Rivers and Harbors Act of 1899 (RHA) provide that  
17 the Secretary of the Army, on the recommendation of the Chief of Engineers, may grant permission  
18 for the temporary occupation or use of any sea wall, bulkhead, jetty, dike, levee, wharf, pier, or other  
19 work built by the United States. This permission will be granted by an appropriate real estate  
20 instrument in accordance with existing real estate regulations. This regulation is used to require  
21 permits prior to modifications of Federal project levees. Types of alterations typically requiring a  
22 Section 408 permit are major modifications such as degradations, raisings, and realignments.

23 Sections 9 and 10 of RHA authorize USACE to regulate the construction of any structure or work  
24 within navigable waters. The RHA authorizes USACE to regulate the construction of infrastructure  
25 such as wharves, breakwaters, or jetties; bank protection or stabilization projects; permanent  
26 mooring structures, vessels, or marinas; intake or outfall pipes; canals; boat ramps; aids to  
27 navigation; or other modifications affecting the course, location condition, or capacity of navigable  
28 waters. USACE's jurisdiction under RHA is limited to "navigable water," or waters subject to the ebb  
29 and flow of the tide shoreward to the mean high water mark that may be used to transport  
30 interstate or foreign commerce. USACE must consider the following criteria when evaluating  
31 projects within navigable waters: (1) the public and private need for the activity; (2) reasonable  
32 alternative locations and methods; and (3) beneficial and detrimental effects on the public and  
33 private uses to which the area is suited (City of Stockton 2005).

### 34 **Emergency Flood Control Funds Act of 1955**

35 In addition to regulatory activities, USACE has a number of projects and functions that can  
36 potentially affect activities in the Delta. The Emergency Flood Control Fund Act, Public Law 84 99,  
37 authorizes emergency funding and response for levee repairs and flood preparation. USACE can  
38 provide flood fighting readiness within hours; however, this action is supplemental to services  
39 provided by local reclamation districts and State agencies. USACE and DWR have a working  
40 relationship through a memorandum of understanding originally drafted in 1955 and amended  
41 since then (USACE 2005).

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## 1 **USACE Delta Levee Funding**

2 The Water Supply, Reliability, and Environmental Improvement Act of 2004 (Public Law 108 361)  
3 authorizes the USACE to design and construct levee stability projects for purposes such as flood  
4 damage reduction, ecosystem restoration, water supply, water conveyance, and water quality  
5 objectives as outlined in the CALFED Bay Delta Program, Programmatic ROD (CALFED 2000c).  
6 Furthermore, section 103(f)(3)(B) of this Act authorizes the USACE to undertake the eight following  
7 activities:

- 8 ☐ Reconstruct Delta levees to a base level of protection (also known as the "Public Law 84 99  
9 standard")
- 10 ☐ Enhance the stability of levees that have particular importance in the system through the Delta  
11 Levee Special Improvement Projects Program
- 12 ☐ Develop best management practices to control and reverse land subsidence on Delta islands
- 13 ☐ Develop a Delta Levee Emergency Management and Response Plan that will enhance the ability  
14 of federal, State, and local agencies to rapidly respond to levee emergencies
- 15 ☐ Develop a Delta Risk Management Strategy after assessing the consequences of Delta levee  
16 failure from floods, seepage, subsidence, and earthquakes
- 17 ☐ Reconstruct Delta levees using, to the maximum extent practicable, dredged materials from the  
18 Sacramento River, the San Joaquin River, and the San Francisco Bay
- 19 ☐ Coordinate Delta levee projects with flood management, ecosystem restoration, and levee  
20 protection projects of the lower San Joaquin River and lower Mokelumne River floodway  
21 improvements and other projects under the Sacramento San Joaquin Comprehensive Study
- 22 ☐ Evaluate and, if appropriate, rehabilitate the Suisun Marsh levees

23 The Act directed the USACE to identify and prioritize levee stability projects that could be carried  
24 out with federal funds. An initial amount of \$90 million was authorized, with another \$106 million  
25 authorized in the 2007 Water Resources Development Act of 2007 (WRDA). The USACE initially  
26 solicited proposals for various levee improvement projects and received 68 project proposals  
27 totaling more than \$1 billion. In the short term, the USACE plans to proceed with implementation of  
28 high priority improvements that can be constructed with the limited funds appropriated to date.

29 The USACE also is proceeding with a Delta Islands and Levees Feasibility Study to develop long term  
30 plans for flood risk management, water quality, water supply, and ecosystem restoration. In  
31 addition, the USACE is working on a Lower San Joaquin Feasibility Study to determine whether there  
32 is a federal interest in providing flood risk management and ecosystem restoration on the lower San  
33 Joaquin River.

## 34 **Water Resources Development Act of 2007**

35 The Water Resources Development Act of 2007, or Public Law 110 114, includes the National Levee  
36 Safety Act of 2007 (Title IX), which established the National Levee Safety Committee. This also  
37 authorized a report to Congress summarizing the condition of levees in the United States, including  
38 both Federal and non Federal levees.

39 The Water Resources Development Act amended the authority granted to the USACE under PL 108  
40 361. The USACE issued guidance for the implementation of the supplemental authority granted

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1 under section 3015 of Water Resources Development Act. This guidance was issued through a  
2 CECW PB Memorandum dated 11 August 2008 titled, "Implementation Guidance for the Water  
3 Resources Development Act of 2007 (WRDA 2007) Section 3015, CALFED Levee Stability."

#### 4 **Operations and Maintenance Controls, Flood Control Projects**

5 The maintenance and operation of Federal project levee structures is discussed in 33 CFR 208.10.  
6 According to these regulations, no improvement shall be passed over, under, or through the walls,  
7 levees, improved channels, or floodways, nor shall any excavation or construction be permitted  
8 within the limits of the project right of way, nor shall any change be made in any feature of the  
9 works without prior determination by the District Engineer of the Department of the Army or his or  
10 her authorized representative that such improvement, excavation, construction, or alteration will  
11 not adversely affect the function of the protective facilities. This regulation is the basis for requiring  
12 a permit prior to any construction at Federal project levees. Types of alterations/modifications  
13 typically covered by a 208 permit include bridges, pump houses, stairs, pipes, bike trails, and power  
14 poles.

#### 15 **USACE Rehabilitation and Inspection Program**

16 The Rehabilitation and Inspection Program is the USACE program that provides for the inspection of  
17 flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of  
18 federally authorized and constructed hurricane or shore protection projects. Levees in the program  
19 are eligible for federally funded repair and rehabilitation for damage induced by flood events,  
20 provided funding is available. The project levees in the Delta, those levees previously authorized or  
21 constructed under a federal flood control project, are eligible for the program as long as the non  
22 federal sponsor maintains the levees to certain federal standards. Repairs and rehabilitation are  
23 accomplished under provisions of Public Law 84 99, with some cost sharing normally required for  
24 nonproject levees. Nonproject levees are managed and maintained by local districts, as opposed to  
25 project levees, which are part of a larger regional or State project, and managed and maintained by a  
26 federal or State agency.

27 For nonproject levees in the Delta to be eligible, the local maintaining agency must first apply for  
28 participation into the program. To be admitted, the levees must meet certain requirements, and be  
29 maintained to federal levee standards, and pass a rigorous initial inspection. They must also pass  
30 subsequent routine inspections to remain in the program. Very few levees in the central Delta meet  
31 these standards or pass the initial inspections. Remaining in the program will be more challenging in  
32 the future, even for project levees, because the USACE has begun enforcing more stringent  
33 vegetation standards that call for no woody vegetation on levees or within 15 feet of levees. These  
34 standards may also affect the design of habitat restoration projects on the water side of existing  
35 levees.

36 The Public Law 84 99 standard is a minimum requirement for all federal flood control project  
37 levees, such as the Sacramento or San Joaquin River Flood Control Projects. The standard was  
38 developed for major rivers, such as the Mississippi River, and was not necessarily appropriate for  
39 the non federal flood control project levees. In 1987, USACE developed a Delta specific standard  
40 based on the Delta organic soils and levee foundation conditions. Compliance with this standard  
41 allows for USACE emergency assistance for levee rehabilitation and island restoration following  
42 levee failures and island inundation, provided the reclamation district applies for and is accepted  
43 into the program and passes a rigorous initial inspection and periodic follow up inspections.

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#### 1 **6.2.1.4 U.S. Bureau of Reclamation**

2 Reclamation owns and manages several dams and distribution canals upstream of and within the  
3 Delta. Its upstream reservoirs and dams include such major facilities as Shasta, Folsom, New  
4 Melones, and Friant dams. These multipurpose facilities regulate flows to the Delta and provide  
5 water supply, hydroelectric, flood control, recreation, and other benefits. Reclamation consults with  
6 the State and provides technical assistance related to reservoir reoperation studies. Reservoir  
7 operations are covered in Chapter 5, Water Supply.

#### 8 **6.2.1.5 Other Federal Agencies**

9 Other federal agencies have programs related to floodplain management. These include USGS and  
10 the Natural Resources Conservation Service (DWR 1997).  
11 USGS, in cooperation with DWR, is responsible for collecting surface water data, which becomes the  
12 primary database used to develop the hydrologic information required for defining hydraulic  
13 studies.  
14 The Natural Resources Conservation Service is involved in watershed planning. It has programs that  
15 can provide assistance to local governments and the State in constructing flood relief facilities and  
16 preventing flood damage.

#### 17 **6.2.1.6 CALFED Bay Delta Program Levee System Integrity Program**

18 The CALFED Bay Delta Program's Levee System Integrity Program is a federal and state program  
19 that provides maintenance and improvement work to the Delta levee system. Goals and objectives of  
20 the program include:  
21 □ Base Level Protection – This program provides funding to help local reclamation districts  
22 reconstruct Delta levees to a base level of protection (Public Law 84 99).  
23 □ Special Improvement Projects – This program is intended to enhance levee stability for  
24 particularly important levees. Priorities include protection of life, personal property, water  
25 quality, the Delta ecosystem, and agricultural production.  
26 □ Suisun Marsh Protection and Ecosystem Enhancement – This program provides levee integrity,  
27 ecosystem restoration, and water quality benefits by supporting maintenance and improvement  
28 of the levee system in the Suisun Marsh.  
29 □ Levee Emergency Response Plan – This program is intended to enhance agency and local efforts  
30 to respond to levee emergencies.

### 31 **6.2.2 State Plans, Policies, and Regulations**

32 State plans, policies, and regulations related to surface water address water rights issues and flood  
33 management issues. Regulations that address water quality are described in Chapter 8, Water  
34 Quality.

#### 35 **6.2.2.1 California Water Rights**

36 In California, both the riparian doctrine and the prior appropriation doctrine apply (dual system).  
37 Riparian rights result from the ownership of land bordering a surface water source and are normally

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1 senior in priority to most appropriative rights. Owners with riparian water rights may use natural  
2 flows directly for beneficial purposes on adjoining lands without a permit from the State Water  
3 Resources Control Board (State Water Board).  
4 Appropriative rights are obtained by diverting surface water and applying it to a beneficial use.  
5 Before 1914, appropriative rights could be obtained by diverting and using the water, posting a notice  
6 of appropriation at the point of diversion, and recording a copy of the notice with the county  
7 recorder. Since 1914, the acquisition of an appropriative right requires a permit from the State  
8 Water Board.  
9 The State Water Board is responsible for overseeing the water rights and water quality functions in  
10 California. It has jurisdiction to issue permits and licenses for appropriation from surface and  
11 underground streams; whereas the California courts generally have jurisdiction over the use of  
12 infiltrating groundwater, riparian use of surface waters, and the appropriative use of surface waters  
13 from diversions begun before 1914.

#### 14 **6.2.2.2 Porter Cologne Water Quality Control Act**

15 The Porter Cologne Water Quality Control Act (Porter Cologne Act) established the State Water  
16 Board and the Regional Water Quality Control Boards (RWQCBs) as the principal State agencies with  
17 primary responsibility for the coordination and control of water quality (Water Code section  
18 13001), including the enforcement of applicable laws and regulations. The State Water Board is  
19 responsible for allocating surface water rights (SWRCB 2011).

20 Under the Porter Cologne Act, waters of the State fall under jurisdiction of the State Water Board  
21 and the nine RWQCBs. "Waters of the State" are any surface or groundwater body within the  
22 boundaries of the State (Water Code section 13050(e)). The State Water Board and the RWQCBs  
23 also have delegated federal authority to implement the requirements of the federal Clean Water Act  
24 in California, which is largely done through the implementation of the Porter Cologne Act.

25 Under the Porter Cologne Act, the RWQCBs must prepare and periodically update water quality  
26 control plans, also known as basin plans. Each basin plan sets forth water quality objectives  
27 sufficient to ensure reasonable protection of designated beneficial uses of surface water and  
28 groundwater, as well as actions to control nonpoint and point sources of pollution. Any person who  
29 discharges or proposes to discharge any waste that could affect the quality of the waters of the State  
30 must file a "report of waste discharge" with the appropriate RWQCBs "Waste" includes any and all  
31 waste substances associated with human habitation, of human or animal origin, or from any  
32 producing, manufacturing or processing operation (Water Code section 13050(d)). Upon receipt of a  
33 report of waste discharge, the RWQCBs may then issue "waste discharge requirements" designed to  
34 ensure compliance with applicable water quality objectives and other requirements of the Basin  
35 Plan.

#### 36 **6.2.2.3 1995 Water Quality Control Plan and Water Rights Decision D 1641**

37 The 1995 WQCP was developed as a result of the 1994 Bay Delta Accord, which committed the CVP  
38 and SWP to new Delta habitat objectives. The new objectives were adopted through a Water Rights  
39 Decision D 1641 for CVP and SWP operations. One of the main features of the 1995 Water Quality  
40 Control Plan was the estuarine habitat objectives ("X2") for Suisun Bay and the western Delta. The  
41 X2 standard refers to the position at which 2 parts per thousand salinity occurs in the Delta estuary,  
42 and is designed to improve shallow water fish habitat in the spring of each year. Other elements of

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1 the 1995 Water Quality Control Plan include export to inflow ratios intended to reduce entrainment  
2 of fish at the export pumps, Delta Cross Channel gate closures, minimum Delta outflow  
3 requirements, and San Joaquin River salinity and flow standards.

#### 4 **6.2.2.4 Suisun Marsh Preservation Agreement**

5 On March 2, 1987, the Suisun Marsh Preservation Agreement was signed by DWR, DFG, Reclamation,  
6 and the Suisun Resource Conservation District. The purpose of the agreement was to establish  
7 mitigation for impacts on salinity from the SWP, CVP, and other upstream diversions. The Suisun  
8 Marsh Preservation Agreement has the following objectives:

- 9 ☐ To ensure that Reclamation and DWR maintain a water supply of adequate quantity and quality  
10 to manage wetlands in the Suisun Marsh (to mitigate adverse effects on these wetlands from  
11 SWP and CVP operations, as well as a portion of the adverse effects of other upstream  
12 diversions)
- 13 ☐ To improve Suisun Marsh wildlife habitat on these managed wetlands
- 14 ☐ To define the obligations of Reclamation and DWR necessary to ensure the water supply,  
15 distribution, management facilities, and actions necessary to accomplish these objectives
- 16 ☐ To recognize that water users in the Suisun Marsh (i.e., existing landowners) divert water for  
17 wildlife habitat management in the Suisun Marsh

18 In 2000, the CALFED ROD was signed, which included the Environmental Restoration Program  
19 (ERP) calling for the restoration of 5,000 to 7,000 acres of tidal wetlands and the enhancement of  
20 40,000 to 50,000 acres of managed wetlands (CALFED 2000b). In 2001, the U.S. Fish and Wildlife  
21 Service, federal Bureau of Reclamation, Department of Fish and Game (DFG), DWR, National Marine  
22 Fisheries Service, Suisun Resource Conservation District, and CALFED Bay Delta Program (the  
23 Principal Agencies) directed the formation of a charter group to develop a plan for Suisun Marsh  
24 that would balance the needs of CALFED, the Suisun Marsh Preservation Agreement, and other plans  
25 by protecting and enhancing existing land uses, existing waterfowl and wildlife values including  
26 those associated with the Pacific Flyway, endangered species, and State and Federal water project  
27 supply quality. In addition to the Principal Agencies, the charter group includes other regulatory  
28 agencies such as USACE, Bay Conservation and Development Commission, State Water Board, and  
29 RWQCBs.

30 In 2011, the Principal Agencies completed a Final EIS/EIR (Reclamation 2011) that describes three  
31 alternative 30 year plans and their potential impacts. The adopted alternative will become the  
32 Suisun Habitat Management, Preservation, and Restoration Plan. The plan purposes/objectives to  
33 implement the CALFED ROD Preferred Alternative of restoration of 5,000 to 7,000 acres of tidal  
34 marsh and protection and enhancement of 40,000 to 50,000 acres of managed wetlands; maintain  
35 the heritage of waterfowl hunting and other recreational opportunities and increase the  
36 surrounding communities' awareness of the ecological values of Suisun Marsh; maintain and  
37 improve the Suisun Marsh levee system integrity to protect property, infrastructure, and wildlife  
38 habitats from catastrophic flooding; and protect and, where possible, improve water quality for  
39 beneficial uses in Suisun Marsh.

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## 1    **6.2.2.5    Department of Water Resources**

2    DWR's mission is to manage the State's water resources, in cooperation with other agencies, to  
3    benefit the public and to protect, restore, and enhance the natural and human environments. Within  
4    this mission, DWR's goal, as related to flood, is to "protect public health, life, and property by  
5    regulating the safety of dams, providing flood protection, and responding to emergencies." DWR  
6    meets these responsibilities through the following activities (DWR Web site and Water Code section  
7    6000):

- 8    □ Supervising design, construction, enlargement, alteration, removal, operation, and maintenance
- 9    □ of more than 1,200 jurisdictional dams
- 10   □ Encouraging preventive floodplain management practices; regulating activities along Central
- 11   □ Valley floodways
- 12   □ Maintaining and operating specified Central Valley flood control facilities
- 13   □ Cooperating in flood control planning and facility development
- 14   □ Maintaining the State Federal Flood Operations Center and the Eureka Flood Center to provide
- 15   □ flood advisory information to other agencies and the public
- 16   □ Cooperating and coordinating in flood emergency activities and other emergencies
- 17   □ DWR also owns and operates the State Water Project (SWP), with numerous water storage and
- 18   □ conveyance facilities throughout the state. DWR exports water from the Delta at its North Bay
- 19   □ Pumping Plant at Barker Slough and at the Harvey O. Banks Pumping Plant in the south Delta.

## 20   **State Delta Levees Maintenance Subvention Program**

21   The Delta Levees Maintenance Subvention Program is a State cost sharing program in which  
22   participating local levee maintenance agencies receive funds for the maintenance and rehabilitation  
23   of nonproject levees in the Delta. The program's goal is "to reduce the risk to land use associated  
24   with economic activities, water supply, infrastructure, and ecosystem from catastrophic breaching  
25   of Delta levees by building all Delta levees to the Bulletin 192 '82 Standard" (DWR 1995). There is a  
26   statewide interest in levee maintenance in the Delta because the islands levees maintain flow  
27   velocities in the sloughs and channels that combat saltwater intrusion. The program is authorized in  
28   the Water Code, sections 12980-12995. In 1988, with the passage of the Delta Flood Protection Act,  
29   financial assistance for several communities maintaining local Delta levees was increased through  
30   the Delta Levees Subvention Program. The intent of the program is given in Water Code article  
31   12981 and states that the key to preserving the Delta physical characteristics is the system of levees  
32   defining the waterways and producing the adjacent islands. Thus, funds necessary to maintain and  
33   improve the Delta's levees to protect the physical characteristics should be used.

## 34   **Delta Levees Special Flood Projects Program**

35   The Delta Levees Special Flood Control Projects (Special Projects) provides financial assistance to  
36   local levee maintaining agencies for levee rehabilitation in the Delta. The program was established  
37   by the California Legislature under SB 34 in 1988. Since the inception of the program, more than  
38   \$200 million has been provided to local agencies in the Delta for flood control and related habitat  
39   projects. For example, some levees were raised above the 1 percent annual chance water surface  
40   elevations, such as on Webb Tract, Bouldin Island, Empire Tract, King Island, Ringe Tract, and Canal  
41   Ranch (California Central Valley Flood Control Association 2011).

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#### 1 **6.2.2.6 Assembly Bill 1200**

2 Assembly Bill 1200 (Laird 2005) highlighted the complex water issues in the Delta and directed  
3 DWR and DFG to report to the Legislature and Governor on the following:

- 4 ☐ Potential impacts of levee failures on water supplies derived from the Delta because of future
- 5 subsidence, earthquakes, floods, and effects of climate change
- 6 ☐ Options to reduce the impacts of these factors
- 7 ☐ Options to restore salmon and other fisheries that use the Delta estuary

8 The bill added section 139.2 of the Water Code: "The department shall evaluate the potential  
9 impacts on water supplies derived from the Delta based on 50 , 100 , and 200 year projections for  
10 the following possible impacts on the Delta of subsidence; earthquakes ; floods; and changes in  
11 precipitation, temperature, and ocean levels; and a combination of these impacts"

12 DWR and DFG published their first evaluation report as required by AB 1200 in January 2008. The  
13 report, titled "Risks and Options to Reduce Risks to Fishery and Water Supply Uses of the  
14 Sacramento San Joaquin Delta," was issued in 2008 and summarizes the potential risks to water  
15 supplies in the Sacramento San Joaquin Delta attributable to future subsidence, earthquakes, floods,  
16 and climate change. The report identifies potential improvements to reduce these risks (DWR and  
17 DFG 2008). This report was based in part on the information provided as part of the Delta Risk  
18 Management Strategy investigations and analyses, also developed in 2008 and mandated by DWR.

#### 19 **6.2.2.7 Central Valley Flood Protection Board**

20 The CVFPB, previously known as the Reclamation Board, was created in 1911. Its purpose was to  
21 help manage flood risks in the Central Valley on a systemwide basis through the development of a  
22 comprehensive flood control plan for the Sacramento and San Joaquin rivers, and to act as the non  
23 federal sponsor for federal flood control projects in the Central Valley. The CVFPB has jurisdiction  
24 throughout the Sacramento and San Joaquin valleys, which is synonymous with the drainage basins  
25 of the Central Valley, and includes the Sacramento San Joaquin Drainage District.

26 The CVFPB's mission is:

- 27 ☐ To control flooding along the Sacramento and San Joaquin rivers and their tributaries in
- 28 cooperation with the USACE.
- 29 ☐ To cooperate with various agencies of the federal, State, and local governments in establishing,
- 30 planning, constructing, operating, and maintaining flood control works.
- 31 ☐ To maintain the integrity of the existing flood control system and designated floodways through
- 32 its regulatory authority by issuing permits for encroachments.

33 The CVFPB is a major partner for federal flood control works in the Central Valley. The CVFPB  
34 shares costs with the federal government and the local districts and provides land easements and  
35 rights of way for federal projects. The CVFPB assumes responsibility for operation and maintenance  
36 only after a local maintenance agency has agreed to assume ultimate responsibility for the operation  
37 and maintenance. The CVFPB also approves or denies plans for reclamation, dredging, or  
38 improvements that alter any project levee. It has authority to approve or deny any land reclamation  
39 plan (related to public works) or flood protection that involves excavation near rivers and

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1 tributaries, and has legal responsibility for oversight of the entire Central Valley flood management  
2 system.

3 The CVFPB also adopts floodway boundaries and approves uses within those floodways. The  
4 purpose of the designated floodway program is to control encroachments and development within  
5 the floodways and to preserve floodways to protect lives and property. Various uses are permitted  
6 in the floodways, such as agriculture, canals, low dikes and berms, parks and parkways, golf courses,  
7 sand and gravel mining, structures that will not be used for human habitation, and other facilities  
8 and activities that will not be substantially damaged by the base flood event and will not cause  
9 adverse hydraulic impacts that will raise the water surface in the floodway. A permit from CVFPB is  
10 required for most activities other than normal agricultural practices within the boundaries of  
11 designated floodways. The only designated floodways in the Delta are along the Colusa and  
12 Mokelumne rivers up to their confluence with each other and the Stanislaus River up to its  
13 confluence with the San Joaquin River.

14 Title 23 of the California Code of Regulations and the Water Code provide guidance to DWR and  
15 CVFPB on how to enforce appropriate standards for flood control projects in the Central Valley.  
16 These codes provide DWR and CVFPB with the authority to enforce standards for the erection,  
17 maintenance, and operation of levees, channels, and other flood control works within their  
18 jurisdiction.

#### 19 **6.2.2.8 Delta Protection Act of 1992**

20 The Delta Protection Act is described in Section 1.0, Water Resources Regulatory Framework. The  
21 Delta Protection Act of 1992 created the Delta Protection Commission and declared that a primary  
22 goal of the State for the Delta is, among other findings, to improve flood protection by structural and  
23 nonstructural means to ensure an increased level of public health and safety. Section 29704 of the  
24 Delta Protection Act focuses on the Delta levee system. The section recognizes that some of the Delta  
25 islands are flood prone, and that improvement and ongoing maintenance of the levee system is very  
26 important to protect farmlands, population centers, the State's water quality, and significant natural  
27 resource and habitat areas of the Delta. Section 29704 also notes that most of the existing levee  
28 systems are degraded and in need of restoration, improvement, and continuing management.


29 Other sections include goals pertaining to the quality of the Delta environment (agriculture, wildlife  
30 habitat, and recreational activities) and the balanced conservation and development of Delta land  
31 resources.

#### 32 **6.2.2.9 State Realty Disclosure Law**

33 California law (Government Code [Government Code] section 8589.3) requires the seller (if acting  
34 without an agent) or the seller's agent to disclose to a prospective transferee of real property if the  
35 property is located within an SFHA (any type Zone "A" or "V") as designated by FEMA pursuant to 42  
36 USC section 4001. Disclosure must be made if:

- 37 ☐ A seller (if acting without an agent) or the seller's agent has "actual knowledge" (Public  
38 Resources Code section 2621.9(c)(1)) that the property is located within a SFHA, or
- 39 ☐ The local jurisdiction has compiled a list of properties (identified by parcel) that are within an  
40 SFHA and a notice has been posted at the offices of the county recorder, county assessor, and  
41 county planning agency that identifies the location of the parcel list.

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I would say "down" to its confluence with the San Joaquin River rather than "up".

### 6.2.3 Regional and Local Plans, Policies, and Regulations

Local and regional flood management is provided through reclamation districts, individual cities and counties, and regional agencies composed of a combination of the former three, and created through a Joint Exercise of Powers Agreement.


The six counties that have lands within the Delta, as well as cities and special districts, are engaged in activities to reduce the risk of flooding. Activities may include construction, operation, and maintenance of structural features such as levees, and nonstructural activities. Nonstructural activities reduce property damage and loss of life and minimize economic impact in the event of a flood. These include floodplain zoning, enforcement of building restrictions in FEMA designated regulatory floodplains, flood warning and evacuation plans, and flood proofing and relocation assistance.

Several regional flood control agencies also address the Delta. The Sacramento Area Flood Control Agency is a regional agency charged with flood risk reduction to the City of Sacramento, other portions of Sacramento County, and portions of Sutter County. SAFCA's flood control system features include levees along the Sacramento River that protect Natomas and Sacramento, levees on the American River in Sacramento, and levees and floodwalls along the South Sacramento County Streams Group (SAFCA Website 2009).


The San Joaquin Area Flood Control Agency is responsible for flood protection for the City of Stockton and San Joaquin County. In 1998, it completed the Flood Protection Restoration Project, which consisted of improvements to levees, floodwalls, and channels that removed most of the City of Stockton from the FEMA 100 year flood zone (USACE 2008b).

The West Sacramento Flood Control Agency provides flood protection improvements to lower the flood risk to the City of West Sacramento.

*[Note to Lead Agencies: this section is in preparation, and will include information related to DWR agreements with North Delta Water Agency, City of Antioch, CCWD, Solano County Water Agency, and Yolo County Flood Control and Water Conservation Districts.]*

This section describes the potential effects of the action alternatives on surface water resources within the Delta, areas upstream of the Delta, and portions of the SWP and CVP Export Service Areas that could be directly affected by implementation of the alternatives. As previously described in this chapter, some of the SWP and CVP water supplies are conveyed in rivers and streams within Sacramento River and San Joaquin River basins, and thereby, affect surface water flows in  basins. In San Francisco Bay, Central Coast, South Coast, Tulare Lake, South Lahontan, and Colorado River hydrologic basins, SWP and CVP water supplies are conveyed in pipelines and canals and do not directly affect surface waters. Construction of facilities under the alternatives all would occur in the Delta of the Sacramento River and San Joaquin River basins. Therefore, the environmental consequences are focused on changes in surface water resources in the Sacramento River and San Joaquin River basins. Chapter 8, Water Quality, describes potential effects to surface water quality in the Sacramento and San Joaquin River basins and the Delta.

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Is it Colorado River or Colorado Desert?



## 6.3 Environmental Consequences

[Note to Lead Agencies: figures for this chapter and Appendix 4A are in preparation.]

### 6.3.1 Methods for Analysis

The surface water analysis addresses changes to surface waters affected by changes in SWP and CVP operations in the Delta Region, Upstream of the Delta Region, and Export Service Areas due to implementation of BDCP conveyance facilities (CM1) and other conservation measures, especially tidal marsh habitat restoration. The alternatives would modify the operations of the SWP and CVP facilities but would not modify the operations of water resources facilities owned and/or operated by other water rights holders. Therefore, surface water resources on many of the tributaries of the Sacramento River and San Joaquin River would not be affected. The surface waters analyzed in this chapter include Sacramento River upstream of the Delta and downstream of Keswick Dam, Trinity River downstream of Lewiston Reservoir, Feather River downstream of Thermalito Dam, American River downstream of Nimbus Dam, surface water diversions into Yolo Bypass, representative Delta channels, and San Joaquin River upstream of the Delta.

#### 6.3.1.1 Quantitative Analysis of Surface Water Resources

The quantitative surface water analysis was conducted using the CALSIM II model. A brief overview of the modeling tools and outputs is provided in Chapter 4, Approach to Environmental Analysis, and a full description of the tools is included in Appendix 4A.

The results of the model alternative simulations are compared to CEQA existing conditions base line and to the NEPA No Action Alternative baseline to assess potential effects of changes in SWP and CVP operations to surface water resources. SWP and CVP water supply operations are managed to meet instream flow requirements, water rights agreements, and refuge water supply agreements in the Sacramento and San Joaquin valleys. Water supplies are provided in a consistent manner in the existing conditions, No Action Alternative, and alternatives for water rights holders (including Delta water rights holders), and refuge water supply agreements. Water quality changes in the surface water resources are described in Chapter 8, Water Quality.

SWP and CVP operations are determined in accordance with federal and state regulations and assumptions for each alternative, as described in Appendix 4A. Factors that effect surface water resources include operational requirements related to water supplies provided by SWP and CVP facilities (including water supplies to downstream water rights holders), SWP and CVP reservoir storage, and Delta outflow. As described in Chapter 5, Water Supply, the ability to release water from storage to SWP and CVP water users is dependent upon the capability of the reservoir to store adequate water to meet: 1) instream releases, especially with cold water to protect aquatic resources, and 2) Delta outflow requirements identified as "X2" to maintain freshwater conditions in the western Delta (as described in Chapter 8, Water Quality). Delta outflow is also considered in the determination of the ability to divert water at the SWP and CVP south Delta intakes to minimize "reverse flow" conditions in which water from the western Delta is conveyed upstream towards the intakes when Delta outflow is relatively low, as described in Appendix 4A.

The discussion in this chapter related to changes in surface water resources as related to changes in SWP and CVP water supply availability in the No Action Alternative and other alternatives is represented by descriptions of the following factors.

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- 1        ▢ SWP and CVP reservoir storage as it relates to flood management operations.
- 2        ▢ Shasta Lake
- 3        ▢ Trinity Lake
- 4        ▢ Lake Oroville
- 5        ▢ Folsom Lake
- 6        ▢ Instream flows.
- 7        ▢ Sacramento River at Freeport (downstream of the confluence with American River and
- 8        diversions into Yolo Bypass and Sacramento Bypass)
- 9        ▢ San Joaquin River at Vernalis (near where the river enters the Delta)
- 10       ▢ Sacramento River downstream of potential north Delta intakes (and upstream of Delta Cross
- 11       Channel gates)
- 12       ▢ Trinity River downstream of Lewiston Reservoir
- 13       ▢ American River downstream of Nimbus Dam
- 14       ▢ Feather River downstream of Thermalito Dam
- 15       ▢ Spills into the Yolo Bypass at Fremont Weir
- 16       ▢ Combined flows for Old and Middle Rivers as an indication of reverse flow conditions in the
- 17       south Delta.

## 18       **Methods to Analyze Changes due to Implementation of Alternatives versus** 19       **Changes due to Sea Level Rise and Climate Change**

20       The analysis presented in this chapter compares simulated surface water conditions in the following  
21       manner:

- 22       Existing conditions (without sea level rise or climate change) and No Action Alternative
- 23       (without sea level rise or climate change)
- 24       ▢ Existing conditions (without sea level rise or climate change) and alternatives (with sea level
- 25       rise and climate change that would occur at Late Long Term around Year 2060)
- 26       ▢ No Action Alternative (without sea level rise or climate change) and alternatives (with sea level
- 27       rise and climate change that would occur at Late Long Term around Year 2060)

28       The results of the comparison of existing conditions and No Action Alternative to the alternatives  
29       reflect differences in water supply conditions due to the following two changes:

- 30       ▢ Changes in surface water conditions due to operations of new facilities constructed under the
- 31       alternative and related changes in SWP/CVP operations, and
- 32       ▢ Changes in surface water conditions due to sea level rise and climate change.

## 33       **Changes Due to Sea Level Rise**

34       As sea level rise occurs, salinity would increase in the western and central Delta. The No Action  
35       Alternative and all of the alternatives include criteria to maintain freshwater in the western Delta in  
36       the spring (Spring X2), and the No Action Alternative and some of the alternatives include criteria to

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## Surface Water

1 maintain Fall X2. There were no changes in the location of X2 (and the related extent of freshwater  
2 in the western Delta) in the No Action Alternative or alternatives when sea level rise occurred. As  
3 sea level rise occurs, more water would need to be released from the SWP and CVP reservoirs to  
4 maintain X2 criteria, therefore, less water would remain in storage at the end of September and less  
5 water would be available for SWP and CVP water supplies both upstream and downstream of the  
6 Delta.

7 Increased salinity in the west Delta near Rock Slough with sea level rise also would change the  
8 ability to divert water from the south Delta intakes sometimes in the fall months. If the salinity is  
9 greater than the allowed criteria, as described in Chapter 8, Water Quality, operations of south Delta  
10 intakes would be limited and water is released from the SWP and CVP reservoirs to maintain fresh  
11 water conditions at Rock Slough. Therefore, less water would be available for SWP and CVP water  
12 supplies downstream of the Delta.

13 The effects do not occur in the No Action Alternative which assumes the same sea level as in existing  
14 conditions.

### 15 **Changes Due to Climate Change**

16 In the future, changes in climate change are assumed to increase the amount of rainfall and decrease  
17 the amount of snow that would occur in the Sacramento and San Joaquin rivers watersheds.  
18 Therefore, peak runoff would be more likely in the late winter and early spring and runoff during  
19 the late spring and summer would be reduced as compared to existing conditions and No Action  
20 Alternative. These conditions could result in higher flood potential in the winter and early spring  
21 months.

22 Reduction in runoff from snowmelt in the summer months would reduce the ability of the SWP and  
23 CVP reservoirs to refill as water is released for downstream water supplies, instream flows, and  
24 Delta outflow. The reduction in reservoir storage would reduce water supply availability for SWP  
25 and CVP water users both upstream and downstream of the Delta.

26 Reduction in runoff in the summer months also would reduce instream flows in the Sacramento and  
27 San Joaquin River. Operations of the south Delta intakes under the No Action Alternative and  
28 alternatives would be dependent upon inflow/export and export/inflow ratios. If there is less inflow  
29 into the Delta, less water can likely be exported by the SWP and CVP.

30 The ability to operate the south Delta intakes also would be limited with less inflow from the San  
31 Joaquin River. The San Joaquin River inflows provide positive Old and Middle River outflows, and  
32 operations of the south Delta intakes lead to negative Old and Middle River outflows. The No Action  
33 Alternative and the alternatives that rely upon south Delta intakes operate with criteria to minimize  
34 reverse flows. If those criteria cannot be achieved, operations of the south Delta intakes could be  
35 limited and less water would be available for export

### 36 **Describing Changes Due to Sea Level Rise and Climate Change as Compared to Changes Due to** 37 **New Facilities and Operations**

38 The differences in water stored in the SWP/CVP reservoirs upstream of the Delta, instream flows in  
39 rivers upstream of the Delta, and Old and Middle River reverse flow conditions due to sea level rise  
40 and climate change are shown through a comparison of No Action Alternative and No Action  
41 Alternative Late Long Term, as presented in Section 6.4, Cumulative Analysis, and described for  
42 each alternative in this section too. In general, the incremental differences in surface water

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#### Surface Water

1 conditions under No Action Alternative due to sea level rise and climate change are similar or  
 2 greater than the differences in surface water conditions under the alternatives as compared to  
 3 surface water conditions under the alternatives.

4 For each alternative, the following impact assessment comparisons are presented for the  
 5 quantitative analyses of reservoir storage, instream flows, and Old and Middle River reverse flow  
 6 conditions.

- 7 ☐ Comparison of each alternative (at Late Long Term) to existing conditions, which will result in  
 8 changes in surface water conditions that caused by sea level rise, climate change, and  
 9 implementation of the alternative. It is not possible to specifically define the exact extent of the  
 10 changes due to implementation of the alternative using the model simulation results presented  
 11 in this chapter.
- 12 ☐ Comparison of each alternative (at Late Long Term) to No Action Alternative which will result in  
 13 changes in surface water conditions that caused by sea level rise, climate change, and  
 14 implementation of the alternative. It is not possible to specifically define the exact extent of the  
 15 changes due to implementation of the alternative using the model simulation results presented  
 16 in this chapter.
- 17 ☐ Comparison of No Action Alternative Late Long Term to No Action Alternative to indicate the  
 18 general extent of changes in surface water conditions due to sea level rise and climate change.
- 19 ☐ Comparison of each alternative (at Late Long Term) to No Action Alternative Late Long Term  
 20 (which is included in Section 6.4, Cumulative Analysis) to indicate the general extent of changes  
 21 in surface water conditions due to implementation of the alternative.

22 Mitigation measures are related to the changes due to implementation of the alternative and not  
 23 changes due to sea level rise and climate change. Therefore, mitigation measures are related to the  
 24 comparison of each alternative to No Action Alternative Late Long Term.


25 If sea level rise and climate change do not occur or occur differently than modeled for these  
 26 analyses, surface water conditions under the alternatives will be different than the results of the  
 27 model presented in this section.

#### 28 **6.3.1.2 Qualitative Analysis of Flood Management**

29 Changes in flood potential could occur in several ways. First, changes in SWP and CVP operations  
 30 could change available reservoir storage volumes that would be used to store runoff from snowmelt  
 31 and rainstorm in the upper watersheds. Second, instream flow releases during spring months could  
 32 change instream flows.

33 Quantitative analysis of flood potential due to changes in SWP and CVP operations would require  
 34 calculation and evaluation of peak hourly flows in the main river, such as the Sacramento River, and  
 35 the hourly addition of peak hourly flows from tributaries, such as Morrison Creek. The quantitative  
 36 surface water analysis was conducted using CALSIM II, a monthly time step model. The model  
 37 cannot accurately simulate peak hourly flow conditions for both the Sacramento River and the  
 38 tributaries. Without the capability of simulating peak hourly flows, it is not possible to quantitatively  
 39 analyze potential flood flows. Therefore, to analyze changes in flood potential related to reservoir  
 40 storage, a qualitative evaluation will be conducted by comparing changes in reservoir storage at the  
 41 end of May. If the reservoir storage has increased by the end of May, this could be an indication that  
 42 there could be less opportunity to capture runoff from the upper watershed during the spring

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The USACE would still control the space behind these reservoirs reserved for flood reduction and the operation of that space.

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#### Surface Water

1 months. The analysis evaluates changes in storage for Shasta Lake, Oroville Reservoir, and Folsom  
 2 Lake. The analysis does not evaluate changes in storage for reservoirs on the San Joaquin River  
 3 because the operations of Millerton Lake were not changed in the alternatives.

4 To qualitatively evaluate changes in flood potential within the Sacramento River and San Joaquin  
 5 River, predicted peak monthly flows during wet years were compared to flood warning levels in the  
 6 Sacramento River at Freeport (80,000 cfs) and San Joaquin River at Vernalis (32,500 cfs).

7 Assumptions for snowfall and rainfall patterns under Existing Conditions and No Action Alternative  
 8 are not the same as snowfall and rainfall patterns under the alternatives. Existing Conditions and No  
 9 Action Alternative precipitation assumptions are consistent with historical patterns. These historical  
 10 patterns have been used by USACE and DWR to develop reservoir storage criteria to reduce flood  
 11 potential in the watersheds, especially related to snowmelt in the spring months. The assumptions  
 12 for snowfall and rainfall patterns for the alternatives have been modified to reflect climate change  
 13 that is anticipated to increase surface water runoff from rainfall in the winter and early spring and  
 14 decrease runoff from snowmelt in the late spring and early summer, as described in Chapter 5,  
 15 Water Supply. However, the flood management criteria for maintaining adequate flood storage  
 16 space in the reservoirs were not modified to accommodate climate change.

#### 17 **6.3.1.3 Analysis of Surface Water Conditions due to Construction and** 18 **Operation of Conveyance Facilities in the Delta**

19 Construction of facilities within or adjacent to waterways could change surface water elevations or  
 20 runoff characteristics. The analysis describes the potential for temporary construction and long  
 21 term operations activities of the conveyance and the ecosystem restoration facilities to directly or  
 22 indirectly affect local surface water resources related to the following.

- 23 □ Substantial alterations of existing drainage patterns or streams, or increased rate or amount of  
 24 runoff that would result in flooding.
- 25 □ Increased runoff which would exceed the capacity of existing or planned stormwater systems.
- 26 □ Construction of housing within a 100 year flood hazard area.
- 27 □ Exposure of people or structures to a significant risk of loss, injury or death involving flooding,  
 28 including flooding as a result of the failure of a levee or dam.
- 29 □ Construction of structures within a 100 year flood hazard area which would impede or redirect  
 30 flood flows, or be subject to inundation by seiche, tsunami, or mudflow.

#### 31 **6.3.1.4 Project and Program Level Components**

32 For this analysis changes in SWP and CVP surface water resources are evaluated at a project level if  
 33 sufficient detail is available. It should be noted that SWP/CVP water supply operations are affected  
 34 both by specific operations criteria identified for each alternative at a project level basis and by  
 35 assumptions for the location and extent of tidal marsh restoration for each alternative that is  
 36 identified only at a programmatic level.

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## 6.3.2 Determination of Adverse Effects

Effects on surface water conditions were considered adverse if implementation of an alternative would result in one of the following conditions.

- An increase of more than 1% in SWP or CVP reservoir storage in reservoirs located upstream of the Delta in May that could indicate a reduced ability to store flood waters in the winter and spring under the alternatives as compared to reservoir storage under the No Action Alternative Late Long Term (which is used to avoid consideration of changes in reservoir storage caused by sea level rise and climate change). The value of 1% is used to avoid consideration of minor fluctuations in model output due to simulation techniques and assumptions.
- High monthly flows in wet years when flood potential is high in the Sacramento River at Freeport, San Joaquin River at Vernalis, Feather River at Thermalito Dam, or Yolo Bypass at Fremont Weir that exceeded flood capacity at these locations under the alternatives as compared to river flows under the No Action Alternative Late Long Term (which is used to avoid consideration of changes in river flows caused by sea level rise and climate change).
- An increase of more than 1% in flows in the Sacramento River downstream of the proposed locations of north Delta intakes, Trinity River at Lewiston Dam, and American River at Nimbus Dam under the alternatives as compared to high monthly flows in wet years under the No Action Alternative Late Long Term (which is used to avoid consideration of changes in reservoir storage caused by sea level rise and climate change). The value of 1% is used to avoid consideration of minor fluctuations in model output due to simulation techniques and assumptions.
- An increase of more than 1% in reverse flow conditions in Old and Middle River under the alternatives as compared to reverse flows under the No Action Alternative Late Long Term (which is used to avoid consideration of changes in reverse flows caused by sea level rise and climate change). The value of 1% is used to avoid consideration of minor fluctuations in model output due to simulation techniques and assumptions.
- Any alteration of the existing drainage pattern of the site or area of a constructed facility, including through the alteration of the course of a stream or river; or substantial increase in the rate or amount of surface runoff in a manner which would result in flooding on or offsite.
- Creation or contribution of runoff water from a constructed facility which would exceed the capacity of existing or planned stormwater drainage systems.
- Any change that would increase exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of constructed facility.
- Any construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject inundation by mudflow.

The alternatives would not include construction of housing, therefore, this analysis does not include an evaluation of potential flood hazards due to construction of housing within a 100 year flood hazard area as mapped on a federal Flood Hazard Boundary or FIRM or other flood hazard delineation map.

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1 The facilities under existing conditions, No Action Alternative, and alternatives would not be located  
2 in areas that would be subject to tsunamis or seiches, therefore, this analysis does not evaluate the  
3 potential for inundation by these phenomena.

## 4 **6.3.3 Effects and Mitigation Approaches**

### 5 **6.3.3.1 No Action Alternative**

6 The No Action Alternative would include continued implementation of existing maintenance,  
7 enforcement, and protection programs by federal, state, and local agencies, as well as projects that  
8 are permitted or under construction. Operations of the SWP and CVP facilities would change under  
9 the No Action Alternative due to increased water rights demands and implementation of a provision  
10 in U.S. Fish and Wildlife Service 2008 Biological Opinion (USFWS 2009), as described below.

11 □ Increased water rights demands of 482 TAF would occur by 2025. This is primarily an increase  
12 in water rights demands for urban municipal and industrial use north of the Delta, especially in  
13 the communities in El Dorado, Placer, and Sacramento counties. The increased water rights  
14 demand would reduce water supply availability to SWP and CVP water contractors located  
15 upstream and downstream of the Delta and related instream flows that occur during  
16 conveyance of the reduced water supplies.

17 □ Operations of the SWP and CVP under the No Action Alternative would include operations to  
18 meet Fall X2 criteria (see Appendix 4A). These criteria would require release of water from the  
19 SWP and CVP reservoirs in the fall and reduce water supply availability for , and therefore,  
20 reduce SWP and CVP water contractors located upstream and downstream of the Delta and  
21 related instream flows that occur during conveyance of the reduced water supplies.

22 A detailed description of the modeling assumptions associated with the No Action alternative is  
23 included in Appendix 4A.

### 24 **SWP and CVP Reservoir Storage in May and Related Changes to Flood Potential**

25 Reservoir storage in May under long term average conditions for No Action Alternative in Shasta  
26 Lake and Trinity Lake would be reduced by less than 1%; storage in Oroville Reservoir, and Folsom  
27 Lake is reduced by less than 2% as compared to existing conditions, as summarized in Figures 6 10  
28 through 6-13. The changes primarily would be related to increased water rights demands in the  
29 Sacramento River watershed. The changes in reservoir storage would be beneficial related to  
30 potential flood management.

### 31 **Spring Monthly Flows during Wet Years in Sacramento and San Joaquin Rivers and** 32 **Related Changes to Flood Potential**

33 As described above, analysis of monthly flows in the spring months during wet years could be  
34 indicative of the potential for changes in flood management in the Sacramento River at Freeport, San  
35 Joaquin River at Vernalis, Sacramento River upstream of Walnut Grove which would be downstream  
36 of proposed locations of north Delta intakes in the alternatives, Trinity River downstream of  
37 Lewiston Dam, American River downstream of Nimbus Dam, Feather River downstream of  
38 Thermalito Dam, and Yolo Bypass at Fremont Weir.

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**1 Sacramento River at Freeport**

2 Peak monthly flows occur in the Sacramento River at Freeport in February over the long term  
3 average and during wet years, as shown in Figures 6 14 and 6 15. There would be no changes in the  
4 high monthly flows at these locations in the No Action Alternative as compared to existing  
5 conditions, and the flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
6 Freeport.

**7 San Joaquin River at Vernalis**

8 Peak monthly flows occur in the San Joaquin River at Vernalis in March over the long term average  
9 and during wet years, as shown in Figures 6 16 and 6 17. There would be no changes in the high  
10 monthly flows at these locations in the No Action Alternative as compared to existing conditions,  
11 and the flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at Vernalis  
12 when flows are diverted into Paradise Cut.

**13 Sacramento River at Locations Upstream of Walnut Grove**

14 Peak monthly flows occur in the Sacramento River upstream of Walnut Grove in February over the  
15 long term average and during wet years, as shown in Figures 6 18 and 6 19. There would be no  
16 changes in the high monthly flows at these locations in the No Action Alternative as compared to  
17 existing conditions.

**18 Trinity River Downstream of Lewiston Dam**

19 Peak monthly flows occur in the Trinity River downstream of Lewiston Dam in May over the long  
20 term average and during wet years, as shown in Figures 6 20 and 6 21. There would be no changes  
21 in the high monthly flows at these locations in the No Action Alternative as compared to existing  
22 conditions.

**23 American River Downstream of Nimbus Dam**

24 Peak monthly flows occur in the American River downstream of Nimbus Dam in January and  
25 February over the long term average and during wet years, as shown in Figures 6 22 and 6 23.  
26 There would be no changes in the high monthly flows at these locations in the No Action Alternative  
27 as compared to existing conditions.

**28 Feather River Downstream of Thermalito Dam**

29 Peak monthly flows occur in the Feather River downstream of Thermalito Dam in January through  
30 March over the long term average and during wet years, as shown in Figures 6 24 and 6 25. Flood  
31 releases from Lake Oroville to the lower Feather River are generally less than 150,000 cfs when  
32 storage is within the upper flood control space of Lake Oroville. Under No Action Alternative, peak  
33 monthly flows and long term average flows would decrease in the Feather River as compared to  
34 flows under existing conditions. The potential for increase flood risk based upon analysis of monthly  
35 flows would not be an adverse impact.

**36 Yolo Bypass at Fremont Weir**

37 Water generally spills into Yolo Bypass at Fremont Weir when the combined flows in the  
38 Sacramento River and Feather River upstream of Fremont Weir and flows from Sutter Bypass  
39 exceed 56,000 cfs. The Yolo Bypass floodplain capacity can accommodate a flow at Fremont Weir up

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#### Surface Water

1 to 343,000 cfs. Under No Action Alternative, peak flows into the Yolo Bypass at Fremont Weir would  
2 be less than under existing conditions and less than the Yolo Bypass capacity of 343,000 cfs at  
3 Fremont Weir, as shown in Figure 6 26. Therefore, the potential for increase flood risk based upon  
4 analysis of monthly flows would be beneficial.

#### 5 **Reverse Flows in Old and Middle River**

6 Reverse flow conditions for Old and Middle River flows on a long term average basis is similar  
7 under the No Action Alternative as compared to existing conditions except in September through  
8 November. During those months, flows in Old and Middle River would be more positive towards the  
9 Delta due to operations to comply with Fall X2 which reduces operations of the SWP/CVP south  
10 Delta intakes during those months, as shown in Figure 6 27.

#### 11 **Ongoing Plans, Policies, and Programs**

12 The programs, plans, and projects included under the No Action Alternative are summarized in  
13 Chapter 3, Description of Alternatives. Most of the projects would not affect surface water resources  
14 under No Action Alternative as compared to existing conditions. The projects that could affect  
15 SWP/CVP water supply availability are summarized in Table 6 2, along with their anticipated effects  
16 to water supply.

17 **Table 6 2. Effects on Surface Water Resources from the Plans, Policies, and Programs for the No Action**  
18 **Alternative**

Agency	Program/Project	Status	Description of Program/Project	Effects to Water Supply
Contra Costa Water District, Bureau of Reclamation, and California Department of Water Resources	Middle River Intake and Pump Station (previously known as the Alternative Intake Pump Station)	Project completed and was formally dedicated July 20, 2010	This project includes a potable water intake and pump station to improve drinking water quality for Contra Costa Water District customers.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (CCWD 2006).
California Department of Water Resources	Federal Energy Regulatory Commission (FERC) License Renewal for Oroville Project	Draft Water Quality Certification issued December 6, 2010 and comments on Draft received December 10, 2010	The renewed federal license will allow the Oroville Facilities to continue providing hydroelectric power and regulatory compliance with water supply and flood control.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (DWR 2008c).
Freeport Regional Water Authority and Bureau of Reclamation	Freeport Regional Water Project	Project was completed late 2010.	Project includes an intake/pumping plant near Freeport on the Sacramento River and a conveyance structure to transport water through Sacramento County to the Folsom South Canal.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (FRWA 2003).

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Surface Water

Agency	Program/Project	Status	Description of Program/Project	Effects to Water Supply
California Department of Water Resources and Solano County Water Agency	North Bay Aqueduct Alternative Intake Project	Study is ongoing.	This project will construct an alternative intake on the Sacramento River and a new segment of pipeline to connect it to the North Bay Aqueduct system.	No adverse effects on surface water supplies are anticipated because the total diversions would be similar as the diversions allowed under the existing conditions.
City of Stockton	Delta Water Supply Project	Expected completion in 2012.	This project consists of a new intake structure and pumping station adjacent to the San Joaquin River; a water treatment plant along Lower Sacramento Road; and water pipelines along Eight Mile, Davis, and Lower Sacramento Roads.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (Stockton 2005).
Tehama Colusa Canal Authority and Bureau of Reclamation	Red Bluff Diversion Dam Fish Passage Project	Expected completion in 2012.	Proposed improvements include modifications made to upstream and downstream anadromous fish passage and water delivery to agricultural lands within CVP.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (Reclamation 2002).
Bureau of Reclamation, California Department of Fish and Game, and Natomas Central Mutual Water Company	American Basin Fish Screen and Habitat Improvement Project	Expected completion in 2012.	This three phase project includes consolidation of diversion facilities; removal of decommissioned facilities; aquatic and riparian habitat restoration; and installing fish screens in the Sacramento River. Total project footprint encompasses about 124 acres east of the Yolo Bypass.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (Reclamation 2008).
Bureau of Reclamation	Delta Mendota Canal/California Aqueduct Intertie	Expected completion in 2012.	The purpose of the intertie is to better coordinate water delivery operations between the California Aqueduct (state) and the Delta Mendota Canal (federal) and to provide better pumping capacity for the Jones Pumping Plant. New project facilities include a pipeline and pumping plant.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (Reclamation 2009).

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Agency	Program/Project	Status	Description of Program/Project	Effects to Water Supply
Zone 7 Water Agency and California Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Expected completion in 2012.	The project includes construction of a new reservoir and pipelines and canals to increase the capacity of the South Bay Aqueduct.	No adverse effects on surface water resources are anticipated based upon environmental documentation for this project (DWR 2004).

1  
2

3 **CEQA Conclusion:** Surface water resources under No Action Alternative would be similar to  
4 conditions under existing conditions. There would be less reverse flows in Old and Middle Rivers  
5 under No Action Alternative as compared to existing conditions due to operations of the SWP and  
6 CVP to comply with Fall X2 criteria. In total, the ongoing programs and plans under the No Action  
7 Alternative would not result in adverse effects on surface water resources based upon information  
8 presented in related environmental documentation.

9 **6.3.3.2 Alternative 1A—Dual Conveyance with Tunnel and Intakes 1–5**  
10 **(15,000 cfs; Operational Scenario A)**

11 Alternative 1A would result in temporary effects on lands and communities associated with  
12 construction of five intakes and intake pumping plants, and other associated facilities; two forebays;  
13 conveyance pipelines; and tunnels. Nearby areas would be altered as work or staging areas, concrete  
14 batch plants, fuel stations, or be used for spoils disposal areas. Sites used temporarily for borrow  
15 and then for spoils would also be anticipated to have a temporary effect on lands and communities.  
16 Transmission lines, access roads, and other incidental facilities would also be needed for operation  
17 of the project and construction of these structures would have temporary effects on lands and  
18 communities.

19 Changes in SWP/CVP operations under Alternative 1A would result in changes to surface water  
20 conditions. For example, most of the diversions at the north Delta intakes would occur in winter and  
21 spring, and most of the diversions at the south Delta intakes would occur in the summer under  
22 Alternative 1A. Alternative 1A does not include inflow/export ratio criteria for the San Joaquin River  
23 that limits use of the south Delta intakes under existing conditions and No Action Alternative.

24 Alternative 1A also would include installation of operable gates at Fremont Weir to increase the  
25 frequency and duration of inundation of Yolo Bypass and modification of islands and channels in the  
26 Delta and Suisun Marsh to establish tidal marsh, channel margin, and riparian corridor habitat as  
27 compared to existing conditions and No Action Alternative.

28 Alternative 1A would not include operations to comply with Fall X2 criteria. The Fall X2 criteria, as  
29 included in No Action Alternative, increases releases from SWP/CVP reservoirs upstream of the  
30 Delta to increase Delta outflow in September through November when the previous years were  
31 above normal and wet water years. In October, Delta outflows under Alternative 1A, would increase  
32 to reduce salinity in the west Delta and comply with water quality criteria at Rock Slough, as under  
33 existing conditions and No Action Alternative.

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**Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood waters in winter and spring**

Under Alternative 1A, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and the No Action Alternative, as shown in Figures 6 10 through 6 13. However, these differences represent changes under Alternative 1A and changes due to sea level rise and climate change.

Changes due to sea level rise and climate change are indicated through the comparison of or reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and the No Action Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

As described in Section 6.4, Cumulative Analysis, and shown in Figures 6 10 through 6 13, reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May under Alternative 1A would be equal to or less than reservoir storage under No Action Late Long Term. The reduced storage volumes would allow for storage of additional runoff that could reduce the potential for flooding downstream of the reservoirs. The effect would be beneficial related to flood management.

**CEQA Conclusion:** Alternative 1A would increase the ability to store runoff in the spring in the upper Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of the reservoirs. Therefore, Alternative 1A would result in a less than significant impact on flood management.

**Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months of wet years when flood potential is high**

**Sacramento River at Freeport**

Under Alternative 1A, high monthly flows in the Sacramento River at Freeport in February under would be about 3% higher than flows under existing conditions and about 4% higher than flows under No Action Alternative, as shown in Figure 6 14. However, these differences represent changes under Alternative 1A and changes due to sea level rise and climate change.

High monthly flows in wet years in the Sacramento River at Freeport in February under No Action Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at Freeport.

High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative 1A would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a monthly basis, flood potential at these locations would not change under Alternative 1A as compared to No Action Alternative Late Long Term. Therefore, Alternative 1A would result in a beneficial impact on flood management.

**San Joaquin River at Vernalis**

Under Alternative 1A, high monthly flows in the San Joaquin River at Vernalis in March in wet years would be about 5% higher than flows under existing conditions and about 6% higher under No

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Surface Water

- 1 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative
- 2 1A and changes due to sea level rise and climate change.
- 3 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action
- 4 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown
- 5 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at
- 6 Vernalis when flows are diverted into Paradise Cut.
- 7 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 1A
- 8 would be equal to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On a
- 9 monthly basis, flood potential at these locations would not change under Alternative 1A as
- 10 compared to No Action Alternative Late Long Term. Therefore, Alternative 1A would result in no
- 11 impact on flood management.
- 12 **Sacramento River at Locations Upstream of Walnut Grove**
- 13 Under Alternative 1A, high monthly flows in the Sacramento River downstream of the north Delta
- 14 intakes in February would be less than under existing conditions and No Action Alternative, as
- 15 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially
- 16 in April through September when the flows under the No Action Alternative Late Long Term would
- 17 be less than flows under No Action Alternative. However, flows downstream of the north Delta
- 18 intakes would be reduced in all months on a long term average due to the operations of the north
- 19 Delta intakes.
- 20 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 21 February under No Action Alternative Late Long Term would be about 5% higher than under No
- 22 Action Alternative, as shown in Figure 6 18.
- 23 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 24 February under Alternative 1A would be less than flows under No Action Alternative Late Long
- 25 Term, as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not
- 26 change under Alternative 1A as compared to No Action Alternative Late Long Term. Therefore,
- 27 Alternative 1A would result in a beneficial impact on flood management.
- 28 **Trinity River Downstream of Lewiston Dam**
- 29 Under Alternative 1A, high monthly flows in Trinity River downstream of Lewiston Lake in May in
- 30 wet years would be similar to flows under existing conditions and No Action Alternative for, as
- 31 shown in Figure 6 20.
- 32 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No
- 33 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown
- 34 in Figure 6 20.
- 35 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under
- 36 Alternative 1A would be similar to flows under No Action Alternative Late Long Term, as shown in
- 37 Figure 6 20. On a monthly basis, flood potential at these locations would not change under
- 38 Alternative 1A as compared to No Action Alternative Late Long Term. Therefore, Alternative 1A
- 39 would result in no impact on flood management.

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**1 American River Downstream of Nimbus Dam**

2 Under Alternative 1A, high monthly flows in the American River at Nimbus Dam in January and  
3 February in wet years under Alternative 1A would be 20 to 30% higher than flows under existing  
4 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
5 under Alternative 1A and changes due to sea level rise and climate change.

6 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
7 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
8 Alternative, as shown in Figure 6 22.

9 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
10 under Alternative 1A would be similar under No Action Alternative Late Long Term, as shown in  
11 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
12 Alternative 1A as compared to No Action Alternative Late Long Term. Therefore, Alternative 1A  
13 would result in no impact on flood management.

**14 Feather River Downstream of Thermalito Dam**

15 Under Alternative 1A, high monthly flows in wet years in the Feather River at Thermalito Dam in  
16 February would be 34% higher than flows under existing conditions and 44% higher than flows  
17 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
18 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

19 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
20 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
21 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
22 6 24 would not exceed channel capacity of 150,000 cfs in this location.

23 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
24 Alternative 1A would be 12% higher than under No Action Alternative Late Long Term because  
25 water is released from Lake Oroville for diversions at the north Delta intakes in the winter months,  
26 as described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
27 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 1A  
28 would not result in an adverse impact on flood management.


**29 Yolo Bypass at Fremont Weir**

30 Under Alternative 1A, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
31 years would be 37% higher than peak monthly spills under existing conditions and 40% higher than  
32 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
33 related to climate change.

34 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
35 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
36 shown in Figure 6 26.

37 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
38 Alternative 1A would be 9% higher than under No Action Alternative Late Long Term, as shown in  
39 Figure 6 26, because Alternative 1A operations criteria increases spills into the Yolo Bypass to  
40 increase the frequency and inundation period of the Yolo Bypass. as compared to existing conditions  
41 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at

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General comment for all of these alternative analysis e.g. 37% higher peak monthly spills would appear to raise the water surface in the river resulting in greater risk to those people living behind the levees. The flow is less than the capacity of the Yolo Bypass, however, there is an increased risk to those people living behind the levee. The statement made in the first and second lines of page 6-53 is not correct. There is an adverse impact. This is typical for all of the alternatives that raise the water surface elevation.

1 Fremont Weir. Therefore, Alternative 1A would not result in an adverse impact on flood  
2 management.

3 Overall, Alternative 1A would not result in an increase in potential risk for flood management as  
4 compared to existing conditions and the No Action Alternative when the changes due to sea level  
5 rise and climate change are eliminated from the analysis. Flows under Alternative 1A in the  
6 locations considered in this analysis either were similar to or less than flows that would occur in  
7 existing conditions or No Action Alternative without the changes in sea level rise and climate  
8 change; or the increase in flows would be less than the flood capacity for the channels at these  
9 locations. Therefore, Alternative 1A would not result in adverse impacts on flood management.

10 **CEQA Conclusion:** Alternative 1A would not result in increase in potential risk for flood  
11 management as compared to existing conditions and No Action Alternative without the changes due  
12 to sea level rise and climate change are eliminated from the analysis. Flows under Alternative 1A in  
13 the locations considered in this analysis either were similar to or less than flows that would occur in  
14 existing conditions or No Action Alternative without the changes in sea level rise and climate  
15 change; or the increase in flows would be less than the flood capacity for the channels at these  
16 locations. Therefore, Alternative 1A would result in a less than significant impact on flood  
17 management. less than significant

### 18 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

19 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 1A on  
20 a long term average basis except in April and May as compared to reverse flows under existing  
21 conditions and No Action Alternative, as shown in Figure 6 27. Old and Middle River flows would be  
22 less positive in April and May under Alternative 1A as compared to flows under existing conditions  
23 and No Action Alternative because Alternative 1A does not include inflow/export ratio criteria for  
24 the San Joaquin River in those months. Therefore, Alternative 1A would result in beneficial impacts  
25 toward reductions in reverse flow conditions in Old and Middle Rivers in June through March and  
26 adverse impacts with increased reverse flow conditions in April and May.

27 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
28 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
29 River flows would be less likely to occur on a long term average basis except in April and May as  
30 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

31 Reverse flow conditions under Alternative 1A would be less likely to occur on a long term average  
32 basis except in October and April as compared to No Action Alternative Late Long Term.

33 **CEQA Conclusion:** Alternative 1A would provide benefits related to reducing reverse flows in Old  
34 and Middle Rivers in June through March and adverse impacts in increased reverse flow conditions  
35 in April and May as compared to existing conditions. Determination of the significance of this effect  
36 is related to effects on water quality and aquatic resources. Therefore, the significance of these  
37 effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

### 38 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in** 39 **the rate or amount of surface runoff**

40 Construction of the facilities under Alternative 1A would involve construction of intakes in the water  
41 and extensive facilities on the land, as well as construction of habitat restoration in the water.

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Surface Water

1 Construction of the earthen embankments, pumping plants, levees, canals, tunnel access shafts,  
2 forebays, and access roads included in Alternative 1A would require excavation, grading, or  
3 stockpiling at project facility sites or at temporary work sites. These activities would result in  
4 temporary and long term changes to drainage patterns, paths and facilities that would, in turn,  
5 cause changes in drainage flow rates, directions and velocities.

6 Site grading needed to construct any of the proposed facilities has the potential to block, reroute, or  
7 temporarily detain and impound surface water in existing drainages, which would result in  
8 increases and decreases in flow rates, velocities, and water surface elevations. Changes in drainage  
9 depths would vary depending on the specific conditions at each of the temporary work sites. As  
10 drainage paths would be blocked by construction activities, the temporary ponding of drainage  
11 water could occur and result in decreases in drainage flow rates downstream of the new facilities,  
12 increases in water surface elevations, and decreases in velocities upstream of the new facilities.  
13 Alternative 1A facilities could temporarily and directly affect existing water bodies and drainage  
14 facilities, including ditches, canals, pipelines, or pump stations.

15 These temporary changes in drainage would be minimized, and in some cases avoided, by  
16 construction of new or modified drainage facilities, as described in the Chapter 3, Description of  
17 Alternatives. Alternative 1A would include installation of temporary drainage bypass facilities, long  
18 term cross drainage, and replacement of existing drainage facilities that would be disrupted due to  
19 construction of new facilities. These facilities would be constructed prior to disconnecting or  
20 crossing existing drainage facilities. Locations of stockpiles and other temporary construction  
21 features would be selected to minimize flow impedance under flood flow conditions.

22 Paving, compaction of soil and other activities that would increase land imperviousness would  
23 result in decreases in precipitation infiltration into the soil, and thus increase drainage runoff flows  
24 into receiving drainages.

25 Removal of groundwater during construction (dewatering) would be required for excavation  
26 activities. Groundwater removed during construction would be treated as necessary (see Chapter 3,  
27 Description of Alternatives, and Chapter 7, Groundwater), and discharged to local drainage channels  
28 or rivers. This would result in a localized increase in flows and water surface elevations in the  
29 receiving channels. Dewatering would be a continuous operation initiated one to four weeks prior to  
30 excavation and would continue after excavation is completed. The discharge rates of water collected  
31 during construction would be relatively small compared to the capacities of most of the Delta  
32 channels where discharges would occur. Dispersion facilities would be used to reduce the potential  
33 for channel erosion due to the discharge of dewatering flows. Permits for the discharges would be  
34 obtained from the Regional Water Quality Control Board.

35 Intakes constructed under Alternative 1A would be on bank facilities that could encroach into the  
36 existing river cross section and would involve construction activities in the Sacramento River, at the  
37 northern end of the Delta. Construction of intakes would include the installation of cofferdams at  
38 each of the intake locations. The cofferdams would impede river flows, resulting in hydraulic  
39 impacts. Water surface elevations upstream of the cofferdams could increase under flood flow  
40 conditions by approximately 1/2 foot relative to existing conditions and No Action Alternative.  
41 Under existing regulations, the USACE, CVFPB, and DWR would require installation of setback levees  
42 or other measures to maintain existing flow capacity in the Sacramento River during construction  
43 and operations, which would prevent unacceptable increases in river water surface elevations under

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Surface Water

- 1 flood flow conditions, reverse flow areas, areas of high velocities that could result in scour, and
- 2 reflection of flood waves towards other levees.
- 3 Sediment and debris would accumulate at the intake locations and periodic dredging would occur,
- 4 as described in Chapter 3, Description of Alternatives.
- 5 Construction of project facilities could impact agricultural irrigation delivery and return flow canals,
- 6 pumps and other drainage facilities in locations where such agricultural facilities would be crossed
- 7 by intakes, pumping plants, forebays, pipelines, canals, and tunnel access shafts. Stockpiled
- 8 excavated material from forebays and sediment basins could impact agricultural irrigation
- 9 deliveries and return flows. Alternative 1A would include installation of temporary agricultural flow
- 10 bypass facilities and provision of replacement drainage facilities to avoid interruptions in
- 11 agricultural irrigation deliveries or return flows, as described in Chapter 3, Description of
- 12 Alternatives. The temporary flow bypass facilities would be installed and connected before existing
- 13 facilities would be disconnected or otherwise impacted. Replacement drainage facilities would be
- 14 installed and connected before the end of construction of the proposed conveyance facilities.
- 15 Riparian habitat restoration is anticipated to occur primarily in association with the restoration of
- 16 tidal marsh habitat, channel margin habitat, and inundated floodplains. The restored vegetation has
- 17 the potential of increasing channel and/or floodplain roughness, which could result in increases in
- 18 channel water surface elevations, including under flood flow conditions, and in decreased velocities.
- 19 Modified channel geometries could increase or decrease channel velocities and/or channel water
- 20 surface elevations, including under flood flow conditions. Under existing regulations, the USACE,
- 21 CVFPB, and DWR would require the habitat restoration projects to be flood neutral. Measures to
- 22 reduce flood potential could include channel dredging to increase channel capacities and decrease
- 23 channel velocities and/or water surface elevations.
- 24 Expansion of seasonally inundated floodplain restoration areas generally would decrease flows in
- 25 the existing channels under higher flow conditions, resulting in lower channel velocities and water
- 26 surface elevations. Hydraulic roughness in the inundated floodplain areas could vary based on the
- 27 land use that would be allowed there, whether riparian vegetation would be allowed to establish,
- 28 farming would be continued, or residual crop biomass would be used to provide cover,
- 29 hydrodynamic complexity, and organic carbon sources. However, because these inundated areas
- 30 would provide new flow area relative to existing conditions and No Action Alternative, the overall
- 31 hydraulic effect in the existing channels would be to lower channel velocities and water surface
- 32 elevations under high flow conditions.
- 33 In total, Alternative 1A would include measures to address issues associated with alterations to
- 34 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in
- 35 the rivers and streams during construction and operations of facilities. Potential adverse impacts
- 36 could occur due to increased stormwater runoff from paved areas that could increase flows in local
- 37 drainages; and changes in sediment accumulation near the intakes.
- 38 **CEQA Conclusion:** In total, Alternative 1A would include measures to address issues associated with
- 39 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water
- 40 elevations in the rivers and streams during construction and operations of facilities located within
- 41 the waterway. Potential impacts could occur due to increased stormwater runoff from paved areas
- 42 that could increase flows in local drainages and from changes in sediment accumulation near the
- 43 intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this
- 44 potential impact to a less than significant level.

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1 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

2 DWR will implement measures to reduce runoff in land side construction areas and  
3 sedimentation effects in water based construction sites. To reduce the potential for adverse  
4 impacts from large amounts of runoff from paved and impervious surfaces during construction  
5 or operations, DWR would design and implement on site drainage systems in areas where  
6 construction drainage is determined to be an issue. DWR would prepare drainage studies each  
7 construction location to assess the need for, and to finalize other drainage related design  
8 measures, such as a new on site drainage system or new cross drainage facilities. If necessary,  
9 onsite stormwater detention storage would be installed to minimize runoff during construction  
10 or operations.

11 To avoid changes in course of waterbodies, DWR would design measures to prevent  
12 accumulations in water bodies from substantially effecting river hydraulics. A detailed sediment  
13 transport study for all water based facilities would be conducted and a sediment management  
14 plan would be prepared and implemented during construction. The sediment management plan  
15 would include periodic and long term sediment removal actions.

16 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
17 **exceed the capacity of existing or planned stormwater drainage systems**

18 Construction of the facilities under Alternative 1A would contribute runoff from dewater facilities.  
19 As described under Impact SW 4, paving, compaction of soil and other activities that would increase  
20 land imperviousness would result in decreases in precipitation infiltration into the soil, and could  
21 increase drainage runoff flows into receiving drainages.

22 Removal of groundwater during construction (dewatering) would be required for excavation  
23 activities. Groundwater removed during construction would be treated as necessary (see Chapter 8,  
24 Water Quality), and discharged to local drainage channels or rivers. This would result in a localized  
25 increase in flows and water surface elevations in the receiving channels. Dewatering would be a  
26 continuous operation initiated one to four weeks prior to excavation and would continue after  
27 excavation is completed. The discharge rates of water collected during construction would be  
28 relatively small compared to the capacities of most of the Delta channels where discharges would  
29 occur. Dispersion facilities would be used to reduce the potential for channel erosion due to the  
30 discharge of dewatering flows. Permits for the discharges would be obtained from the Regional  
31 Water Quality Control Board, USACE, and CVFPB.

32 Alternative 1A actions would include installation of dewatering facilities in accordance with permits  
33 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 1A would  
34 include provisions to design the dewatering system in accordance with these to avoid adverse  
35 impacts on surface water quality and flows. However, increased runoff could occur from facilities  
36 locations during construction or operations and could result in adverse effects if the runoff volume  
37 exceeds the capacities of local drainages.

38 **CEQA Conclusion:** Alternative 1A actions would include installation of dewatering facilities in  
39 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
40 Alternative 1A would include provisions to design the dewatering system in accordance with these  
41 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
42 occur from facilities locations during construction or operations and could result in significant  
43 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered

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1 significant. Mitigation Measure SW 4 would reduce this potential impact to a level of less than  
2 significant.

3 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

4 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

5 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
6 **or death involving flooding, including flooding as a result of the failure of constructed facility**

7 As described under Impact SW 4, facilities under Alternative 1A would be designed to avoid  
8 increased flood potential as compared to existing conditions or No Action Alternative in accordance  
9 with the requirements of the USACE, CVFPB, and DWR. As described under Impact SW 1, Alternative  
10 1A would not increase flood potential on the Sacramento River, San Joaquin River, or Yolo Bypass.

11 Construction of intakes and stream crossing that would disturb existing levees would be required by  
12 USACE, CVFPB, and DWR to be designed in a manner that would not adversely effect existing flood  
13 protection. Facilities construction would include temporary cofferdams, stability analyses,  
14 monitoring and slope remediation, as described in Chapter 3, Description of Alternatives. For the  
15 slope stability impacts due to excavation of the existing levee for the Sacramento River intake  
16 structures, sheet pile wall installation would minimize the slope stability impacts during  
17 construction of the Sacramento River intakes. For the slope stability impacts due to excavation of the  
18 existing levee for the Byron Tract Forebay, tie back wall installation and dewatering to maintain  
19 slope stability and control seepage would minimize the slope stability impacts associated with  
20 construction of the forebay and approach canal embankments. For the slope stability impacts due to  
21 excavation adjacent to Clifton Court Forebay, providing for tunnel shaft support would minimize the  
22 slope stability impacts during excavation of the main tunnel shaft adjacent to the Clifton Court  
23 Forebay embankment. Dewatering inside the cofferdam or adjacent to the existing levees would  
24 remove waterside slope resistance and lead to slope instability. Slopes would be constructed in  
25 accordance with existing engineering standards, as described in Chapter 3, Description of  
26 Alternatives.

27 Some project facilities could require rerouting of access roads and waterways that could be used  
28 during times of evacuation or emergency response.

29 Construction of tidal marsh habitat, channel margin habitat, and inundated floodplains could  
30 increase flood potential due to impacts on adjacent levees. The newly flooded areas would have  
31 larger wind fetch lengths compared to the existing fetch lengths of the adjacent leveed channels. An  
32 increase in fetch length would result in increases in wave height and velocities that reach the  
33 existing levees along adjacent islands and floodplains. These potential increases in wave action  
34 could also reach the land side of the remaining existing levees around the restoration area. In  
35 accordance with existing requirements of the USACE, CVFPB, and DWR, Alternative 1A would be  
36 designed to avoid increased flood potential as compared to existing conditions or No Action  
37 Alternative.

38 Alternative 1A would not result in an increase to exposure of people or structures to flooding due to  
39 construction or operations of the conveyance facilities or construction of the habitat restoration  
40 facilities because the facilities would be required to comply with the requirements of the USACE,  
41 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water

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1 areas of habitat restoration could cause potential damage to adjacent levees. This impact could  
2 become more substantial with sea level rise and climate change.

3 **CEQA Conclusion:** Alternative 1A would not result in an increase to exposure of people or structures  
4 to flooding due to construction or operations of the conveyance facilities or construction of the  
5 habitat restoration facilities because the facilities would be required to comply with the  
6 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
7 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
8 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
9 potential impact to a level of less than significant.

10 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

11 Wind fetch studies should be completed prior to construction of habitat restoration areas with  
12 increased open water in the Delta to determine levee protection methods for adjacent and  
13 nearby levees.

14 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
15 **impede or redirect flood flows, or be subject to inundation by mudflow**

16 As described under Impact SW 4, facilities under Alternative 1A would include structures within the  
17 100 year flood hazard area, but would not result in impeded or redirected flood flows or conditions  
18 that could lead to mudflows because the structures would be required to meet the criteria of the  
19 USACE, CVFPB, and DWR. As described under Impact SW 4, Alternative 1A also would not increase  
20 flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather  
21 River, or Yolo Bypass, as described under Impact SW 2. Alternative 1A would include measures to  
22 address issues associated with alterations to drainage patterns, stream courses, and runoff and  
23 potential for increased surface water elevations in the rivers and streams during construction and  
24 operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff  
25 from paved areas that could increase flows in local drainages; and changes in sediment  
26 accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4  
27 would reduce this potential impact to a less than significant level.

28 **CEQA Conclusion:** Alternative 1A would not result in an impedance or redirection of flood flows or  
29 conditions that would cause inundation by mudflow due to construction or operations of the  
30 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
31 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
32 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
33 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
34 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
35 potential impact to a less than significant level.

36 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

37 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

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### 6.3.3.3 Alternative 1B—Dual Conveyance with East Canal and Intakes 1–5 (15,000 cfs; Operational Scenario A)

Alternative 1B would result in temporary effects on land and communities in the study area associated with construction of five intakes and intake pumping plants, one forebay, pipelines, canals, tunnels, siphons, and an intermediate pumping plant; alter nearby areas for retrieval of borrowed soils and spoils and tunnel muck disposal; and require development of transmission lines, access roads, and other incidental structures. This alternative would differ from Alternative 1A primarily in that it would use a series of canals generally along the east section of the Delta to convey water from north to south, rather than long segments of deep tunnel through the central part of the Delta.

Operations of the facilities and implementation of the conservation measures would be identical to actions described under Alternative 1A.

#### Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood waters in winter and spring

Effects on SWP and CVP reservoir storage under Alternative 1B would be identical to those described for Impact SW 1 under Alternative 1A because the operations of the facilities would be identical.

**CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 1B would be identical to those described under Alternative 1A because the operations of the facilities would be identical. Therefore, Alternative 1A would result in a less than significant impact on flood management.

#### Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months of wet years when flood potential is high

Effects on surface water flows under Alternative 1B would be identical to those described for Impact SW 2 under Alternative 1A because the operations of the facilities would be identical.

**CEQA Conclusion:** Effects on surface water flows under Alternative 1B would be identical to those described under Alternative 1A because the operations of the facilities would be identical. Therefore, Alternative 1B would result in less than significant river flow impacts on flood management.

#### Impact SW 3. Reverse flow conditions in Old and Middle Rivers

Effects on Old and Middle River flows under Alternative 1B would be identical to those described for Impact SW 3 under Alternative 1A because the operations of the facilities would be identical.

**CEQA Conclusion:** Alternative 1B would provide benefits related to reducing reverse flows in Old and Middle Rivers in June through March and adverse impacts in increased reverse flow conditions in April and May as compared to existing conditions. Determination of the significance of this effect is related to effects on water quality and aquatic resources. Therefore, the significance of these effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

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**Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in the rate or amount of surface runoff**

Effects on alteration of existing drainage patterns under Alternative 1B would be similar to those described for Impact SW 4 under Alternative 1A because the operations of the facilities would be identical and provisions to avoid adverse effects on drainage patterns would be the same. Due to the construction of canals under Alternative 1B as compared to tunnels, the potential for interruption of existing drainage facilities would be higher. However, the same types of activities related to installation of temporary and permanent drainage facilities and restoration of disturbed drainage facilities would occur under Alternative 1B as under Alternative 1A, as described in the Chapter 3, Description of Alternatives.

In total, Alternative 1B would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff; potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes.

**CEQA Conclusion:** In total, Alternative 1B would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff; potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. Potential adverse impacts could occur due increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

**Impact SW 5. Creation or contribution of runoff water from a constructed facility that would exceed the capacity of existing or planned stormwater drainage systems**

Effects on surface waters due to runoff under Alternative 1B would be similar to those described for Impact SW 5 under Alternative 1A because the operations of the facilities would be identical and provisions to avoid adverse effects on surface waters would be the same. Due to the construction of canals under Alternative 1B as compared to tunnels, groundwater dewatering would over a larger area and the amount of dewatering would be increased because canals would require more dewatering activities than tunneling operations that can occur in high groundwater conditions. However, the same types of activities related to installation of temporary and permanent drainage facilities would occur under Alternative 1B as under Alternative 1A, as described in the Chapter 3, Description of Alternatives.

Alternative 1B actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 1B would include provisions to design the dewatering system in accordance with these to avoid adverse impacts on surface water quality and flows. However, increased runoff could occur from facilities locations during construction or operations and could result in adverse effects if the runoff volume exceeds the capacities of local drainages.

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1 **CEQA Conclusion:** Alternative 1B actions would include installation of dewatering facilities in  
2 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
3 Alternative 1B would include provisions to design the dewatering system in accordance with these  
4 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
5 occur from facilities locations during construction or operations, and could result in significant  
6 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered  
7 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
8 level.

9 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

10 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

11 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
12 **or death involving flooding, including flooding as a result of the failure of constructed**  
13 **facilities.**

14 Increased exposure of people or structures to flood risks under Alternative 1B would be similar to  
15 those described for Impact SW 6 under Alternative 1A because the operations of the facilities would  
16 be identical and provisions to avoid adverse effects related to flood potential would be the same and  
17 the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to  
18 avoid increased flood potential. However, increased wind fetch near open water areas of habitat  
19 restoration could cause potential damage to adjacent levees.

20 **CEQA Conclusion:** Alternative 1B would not result in an increase to exposure of people or structures  
21 to flooding due to construction or operations of the conveyance facilities or construction of the  
22 habitat restoration facilities because the facilities would be required to comply with the  
23 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
24 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
25 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
26 potential impact to a less than significant level.

27 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

28 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

29 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
30 **impede or redirect flood flows, or be subject to inundation by mudflow**

31 Effects on flood potential would be similar under Alternative 1B to those described for Impact SW 7  
32 under Alternative 1A because facilities would be designed to avoid increased flood potential as  
33 compared to existing conditions or No Action Alternative in accordance with the requirements of the  
34 USACE, CVFPB, and DWR. As described under Impact SW 4, Alternative 1B would not increase flood  
35 potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather  
36 River, or Yolo Bypass, as described under Impact SW 2. Alternative 1B would include measures to  
37 address issues associated with alterations to drainage patterns, stream courses, and runoff and  
38 potential for increased surface water elevations in the rivers and streams during construction and  
39 operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff  
40 from paved areas that could increase flows in local drainages; and changes in sediment

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1 accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4  
2 would reduce this potential impact to a less than significant level.

3 **CEQA Conclusion:** Alternative 1B would not result in an impedance or redirection of flood flows or  
4 conditions that would cause inundation by mudflow due to construction or operations of the  
5 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
6 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
7 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
8 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
9 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
10 potential impact to a less than significant level.

#### 11 **Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

12 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

### 13 **6.3.3.4 Alternative 1C—Dual Conveyance with West Canal and Intakes W1–** 14 **W5 (15,000 cfs; Operational Scenario A)**

15 Alternative 1C would result in effects on lands and communities in the study area associated with  
16 construction of five intakes and intake pumping plants, one forebay, conveyance pipelines, canals, a  
17 tunnel, culvert siphons, and an intermediate pumping plant. Nearby areas would be altered for the  
18 deposition of spoils. Transmission lines, access roads, and other incidental facilities would also be  
19 needed for operation of the project and construction of these structures would have effects on lands  
20 and communities.

21 Operations of the facilities and implementation of the conservation measures would be identical to  
22 actions described under Alternative 1A.

#### 23 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood** 24 **waters in winter and spring**

25 Effects on SWP and CVP reservoir storage under Alternative 1C would be identical to those  
26 described for Impact SW 1 under Alternative 1A because the operations of the facilities would be  
27 identical.

28 **CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 1C would be  
29 identical to those described under Alternative 1A because the operations of the facilities would be  
30 identical. Therefore, Alternative 1C would result in a less than significant impact on flood  
31 management.

#### 32 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months** 33 **of wet years when flood potential is high**

34 Effects on surface water flows under Alternative 1C would be identical to those described for Impact  
35 SW 2 under Alternative 1A because the operations of the facilities would be identical.

36 **CEQA Conclusion:** Effects on surface water flows under Alternative 1B would be identical to those  
37 described under Alternative 1A because the operations of the facilities would be identical.  
38 Therefore, Alternative 1B would result in less than significant river flow impacts on flood  
39 management.

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1 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

2 Effects on Old and Middle River flows under Alternative 1C would be identical to those described for  
3 Impact SW 3 under Alternative 1A because the operations of the facilities would be identical.

4 **CEQA Conclusion:** Alternative 1C would provide benefits related to reducing reverse flows in Old  
5 and Middle Rivers in June through March and adverse impacts in increased reverse flow conditions  
6 in April and May as compared to existing conditions. Determination of the significance of this effect  
7 is related to effects on water quality and aquatic resources. Therefore, the significance of these  
8 effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

9 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
10 **the rate or amount of surface runoff**

11 Effects on alteration of existing drainage patterns under Alternative 1C would be similar to those  
12 described for Impact SW 4 under Alternative 1A because the operations of the facilities would be  
13 identical and provisions to avoid adverse effects on drainage patterns would be the same. Due to the  
14 construction of canals under Alternative 1C as compared to tunnels, the potential for interruption of  
15 existing drainage facilities would be higher. However, the same types of activities related to  
16 installation of temporary and permanent drainage facilities and restoration of disturbed drainage  
17 facilities would occur under Alternative 1C as under Alternative 1A, as described in the Chapter 3,  
18 Description of Alternatives.

19 In total, Alternative 1C would include measures to address issues associated with alterations to  
20 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
21 the rivers and streams during construction and operations of facilities located within the waterway  
22 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
23 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
24 changes in sediment accumulation near the intakes.

25 **CEQA Conclusion:** In total, Alternative 1C would include measures to address issues associated with  
26 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
27 elevations in the rivers and streams during construction and operations of facilities located within  
28 the waterway. Potential adverse impacts could occur due increased stormwater runoff from paved  
29 areas that could increase flows in local drainages; and changes in sediment accumulation near the  
30 intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
31 potential impact to a less than significant level.

32 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

33 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

34 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
35 **exceed the capacity of existing or planned stormwater drainage systems**

36 Effects on surface waters due to runoff under Alternative 1C would be similar to those described for  
37 Impact SW 5 under Alternative 1A because the operations of the facilities would be identical and  
38 provisions to avoid adverse effects on surface waters would be the same. Due to the construction of  
39 canals under Alternative 1C as compared to tunnels, groundwater dewatering would over a larger  
40 area and the amount of dewatering would be increased because canals would require more  
41 dewatering activities than tunneling operations that can occur in high groundwater conditions.

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#### Surface Water

- 1 However, the same types of activities related to installation of temporary and permanent drainage
- 2 facilities would occur under Alternative 1C as under Alternative 1A, as described in the Chapter 3,
- 3 Description of Alternatives.
- 4 Alternative 1C actions would include installation of dewatering facilities in accordance with permits
- 5 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 1C would
- 6 include provisions to design the dewatering system in accordance with these to avoid adverse
- 7 impacts on surface water quality and flows. However, increased runoff could occur from facilities
- 8 locations during construction or operations and could result in adverse effects if the runoff volume
- 9 exceeds the capacities of local drainages.
- 10 **CEQA Conclusion:** Alternative 1C actions would include installation of dewatering facilities in
- 11 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.
- 12 Alternative 1C would include provisions to design the dewatering system in accordance with these
- 13 to avoid significant impacts on surface water quality and flows. However, increased runoff could
- 14 occur from facilities locations during construction or operations and could result in significant
- 15 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered
- 16 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant
- 17 level.
- 18 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**
- 19 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.
- 20 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**
- 21 **or death involving flooding, including flooding as a result of the failure of constructed facility**
- 22 Increased exposure of people or structures to flood risks under Alternative 1C would be similar to
- 23 those described for Impact SW 6 under Alternative 1A because the operations of the facilities would
- 24 be identical and provisions to avoid adverse effects related to flood potential would be the same and
- 25 the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to
- 26 avoid increased flood potential. However, increased wind fetch near open water areas of habitat
- 27 restoration could cause potential damage to adjacent levees.
- 28 **CEQA Conclusion:** Alternative 1C would not result in an increase to exposure of people or structures
- 29 to flooding due to construction or operations of the conveyance facilities or construction of the
- 30 habitat restoration facilities because the facilities would be required to comply with the
- 31 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased
- 32 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent
- 33 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this
- 34 potential impact to a less than significant level.
- 35 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**
- 36 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.
- 37 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**
- 38 **impede or redirect flood flows, or be subject to inundation by mudflow**
- 39 Effects on flood potential would be similar under Alternative 1C to impacts described for Impact
- 40 SW 7 under Alternative 1A because facilities would be designed to avoid increased flood potential as

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1 compared to existing conditions or No Action Alternative in accordance with the requirements of the  
2 USACE, CVFPB, and DWR. As described under Impact SW 4, Alternative 1C would not increase flood  
3 potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather  
4 River, or Yolo Bypass, as described under Impact SW 2. Alternative 1C would include measures to  
5 address issues associated with alterations to drainage patterns, stream courses, and runoff and  
6 potential for increased surface water elevations in the rivers and streams during construction and  
7 operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff  
8 from paved areas that could increase flows in local drainages; and changes in sediment  
9 accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4  
10 would reduce this potential impact to a less than significant level.

11 **CEQA Conclusion:** Alternative 1C would not result in an impedance or redirection of flood flows or  
12 conditions that would cause inundation by mudflow due to construction or operations of the  
13 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
14 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
15 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
16 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
17 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
18 potential impact to a less than significant level.

19 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

20 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

21 **6.3.3.5 Alternative 2A—Dual Conveyance with Tunnel and Five Intakes**  
22 **(15,000 cfs; Operational Scenario B)**

23 Facilities construction under Alternative 2A would be identical to those described for Alternative  
24 1A. Alternative 2A could involved relocation of two of the intakes to a location south of the  
25 confluence of Sutter and Steamboat sloughs and the Sacramento River.

26 Operations under Alternative 2A would be similar as under Alternative 1A except for the following  
27 actions.

- 28 ☐ Alternative 2A would include operations to comply with Fall X2 criteria that will increase Delta  
29 outflow in September through November when the previous years were above normal and wet  
30 water years, as in the No Action Alternative.
- 31 ☐ Alternative 2A would include operations to restrict use of the south Delta exports through  
32 specific criteria to reduce reverse flows in Old and Middle River to a greater extent than  
33 Alternative 1A. These criteria would reduce use of the south Delta intakes except in April and  
34 May as compared to the No Action Alternative.
- 35 ☐ Alternative 2A would include operations of a removable barrier at the Head of Old River. Use of  
36 this barrier would increase reverse flows in Old and Middle Rivers in April and May because  
37 there would be less water available at these intakes from the San Joaquin River.
- 38 ☐ Due to the restrictions on the use of south Delta intakes, more water would be diverted through  
39 the north Delta intakes from December through July in Alternative 2A as compared to  
40 Alternative 1A. This operation increases total export patterns in the spring months and

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- 1 decreases total exports in the fall months when north Delta intakes operations would be
- 2 constrained by north Delta bypass flows, as described in Chapter 3, Description of Alternatives.
- 3 - Delta outflow increases in fall months in above normal and wet years to comply with Fall X2
- 4 criteria, but decreases in other months due to increased total exports as compared to No Action
- 5 Alternative Late Long Term.
- 6 - Alternative 2A provides for more frequent spills into Yolo Bypass at Fremont Weir to increase
- 7 frequency and extent of inundation.

#### 8 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**

#### 9 **waters in winter and spring**

10 Under Alternative 2A, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville,  
11 and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown  
12 in Figures 6 10 through 6 13. These differences represent changes under Alternative 2A and  
13 changes due to sea level rise and climate change.

14 Changes due to sea level rise and climate change are indicated through the comparison of or  
15 reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
16 under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
17 Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
18 Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

19 Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May  
20 under Alternative 2A would be equal to or less than reservoir storage under No Action Late Long  
21 Term, as described in Section 6.4, Cumulative Analysis. The reduction in reservoir storage at the end  
22 of May would occur because additional water would be diverted at the north Delta intakes under  
23 Alternative 2A in the spring months as compared to the No Action Alternative. The reduced storage  
24 volumes would allow for storage of additional runoff that could reduce the potential for flooding  
25 downstream of the reservoirs. The effect would be beneficial related to flood management.

26 **CEQA Conclusion:** Alternative 2A would increase the ability to store runoff in the spring in the upper  
27 Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
28 the reservoirs. Therefore, Alternative 2A would result in a less than significant impact on flood  
29 management.

#### 30 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**

#### 31 **of wet years when flood potential is high**

#### 32 **Sacramento River at Freeport**

33 Under Alternative 2A, high monthly flows in the Sacramento River at Freeport in February under  
34 would be about 2% higher than flows under existing conditions and lower than flows under No  
35 Action Alternative, as shown in Figure 6 14. However, these differences represent changes under  
36 Alternative 2A and changes due to sea level rise and climate change.

37 High monthly flows in wet years in the Sacramento River at Freeport in February under No Action  
38 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown  
39 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
40 Freeport.

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#### Surface Water

1 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative  
2 2A would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
3 monthly basis, flood potential at these locations would not change under Alternative 2A as  
4 compared to No Action Alternative Late Long Term. Therefore, Alternative 2A would result in a  
5 beneficial impact on flood management.

#### 6 San Joaquin River at Vernalis

7 Under Alternative 2A, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
8 would be about 5% higher than flows under existing conditions and about 6% higher under No  
9 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
10 2A and changes due to sea level rise and climate change.

11 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
12 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
13 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
14 Vernalis when flows are diverted into Paradise Cut.

15 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 2A  
16 would be equal to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
17 monthly basis, flood potential at these locations would not change under Alternative 2A as  
18 compared to No Action Alternative Late Long Term. Therefore, Alternative 2A would result in no  
19 impact on flood management.

#### 20 Sacramento River at Locations Upstream of Walnut Grove

21 Under Alternative 2A, high monthly flows in the Sacramento River downstream of the north Delta  
22 intakes in February would be less than under existing conditions and No Action Alternative, as  
23 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially  
24 in April through September when the flows under the No Action Alternative Late Long Term would  
25 be less than flows under No Action Alternative. However, flows downstream of the north Delta  
26 intakes would be reduced in all months on a long term average due to the operations of the north  
27 Delta intakes.

28 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
29 February under No Action Alternative Late Long Term would be about 5% higher than under No  
30 Action Alternative, as shown in Figure 6 18.

31 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
32 February under Alternative 2A would be less than flows under No Action Alternative Late Long  
33 Term, as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not  
34 change under Alternative 2A as compared to No Action Alternative Late Long Term. Therefore,  
35 Alternative 2A would result in a beneficial impact on flood management.

#### 36 Trinity River Downstream of Lewiston Dam

37 Under Alternative 2A, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
38 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
39 shown in Figure 6 20.

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Surface Water

1 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
2 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
3 in Figure 6 20.

4 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
5 Alternative 2A would be similar to flows under No Action Alternative Late Long Term, as shown in  
6 Figure 6 20. On a monthly basis, flood potential at these locations would not change under  
7 Alternative 2A as compared to No Action Alternative Late Long Term. Therefore, Alternative 2A  
8 would result in no impact on flood management.

9 **American River Downstream of Nimbus Dam**

10 Under Alternative 2A, high monthly flows in the American River at Nimbus Dam in January and  
11 February in wet years under Alternative 2A would be 20 to 30% higher than flows under existing  
12 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
13 under Alternative 2A and changes due to sea level rise and climate change.

14 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
15 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
16 Alternative, as shown in Figure 6 22.

17 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
18 under Alternative 2A would be similar under No Action Alternative Late Long Term, as shown in  
19 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
20 Alternative 2A as compared to No Action Alternative Late Long Term. Therefore, Alternative 2A  
21 would result in no impact on flood management.

22 **Feather River Downstream of Thermalito Dam**

23 Under Alternative 2A, high monthly flows in wet years in the Feather River at Thermalito Dam in  
24 February would be 42% higher than flows under existing conditions and 39% higher than flows  
25 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
26 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

27 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
28 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
29 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
30 6 24 would not exceed channel capacity of 150,000 cfs in this location.

31 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
32 Alternative 2A would be 8% higher than under No Action Alternative Late Long Term because water  
33 is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
34 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
35 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 2A  
36 would not result in an adverse impact on flood management.

37 **Yolo Bypass at Fremont Weir**

38 Under Alternative 2A, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
39 years would be 35% higher than peak monthly spills under existing conditions and 38% higher than

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1 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
2 related to climate change.

3 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
4 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
5 shown in Figure 6 26.

6 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
7 Alternative 2A would be 5% higher than under No Action Alternative Late Long Term, as shown in  
8 Figure 6 26, because Alternative 2A operations criteria increases spills into the Yolo Bypass to  
9 increase the frequency and inundation period of the Yolo Bypass, as compared to existing conditions  
10 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
11 Fremont Weir. Therefore, Alternative 2A would not result in an adverse impact on flood  
12 management.

13 Overall, Alternative 2A would not result in an increase in potential risk for flood management as  
14 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
15 and climate change are eliminated from the analysis. Flows under Alternative 2A in the locations  
16 considered in this analysis either were similar to or less than flows that would occur in existing  
17 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
18 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
19 Alternative 2A would not result in adverse impacts on flood management.

20 **CEQA Conclusion:** Alternative 2A would not result in increase in potential risk for flood  
21 management as compared to existing conditions and No Action Alternative without the changes due  
22 to sea level rise and climate change are eliminated from the analysis. Flows under Alternative 2A in  
23 the locations considered in this analysis either were similar to or less than flows that would occur in  
24 existing conditions or No Action Alternative without the changes in sea level rise and climate  
25 change; or the increase in flows would be less than the flood capacity for the channels at these  
26 locations. Therefore, Alternative 2A would result in a less than significant impact on flood  
27 management.

28 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

29 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 2A on  
30 a long term average basis except in April as compared to reverse flows under existing conditions  
31 and No Action Alternative, as shown in Figure 6 27. Therefore, Alternative 2A would result in  
32 beneficial impacts toward reductions in reverse flow conditions in Old and Middle Rivers in May  
33 through March and adverse impacts with increased reverse flow conditions in April.

34 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
35 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
36 River flows would be less likely to occur on a long term average basis except in April and May as  
37 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

38 Reverse flow conditions under Alternative 2A would be less likely to occur on a long term average  
39 basis except in April as compared to No Action Alternative Late Long Term.

40 **CEQA Conclusion:** Alternative 2A would provide benefits related to reducing reverse flows in Old  
41 and Middle Rivers in May through March and adverse impacts in increased reverse flow conditions  
42 in April as compared to existing conditions. Determination of the significance of this effect is related

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1 to effects on water quality and aquatic resources. Therefore, the significance of these effects are  
2 described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

3 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
4 **the rate or amount of surface runoff**

5 Effects associated with construction and operations of facilities under Alternative 2A would be  
6 identical to those described under Alternative 1A because the facilities would be identical.

7 In total, Alternative 2A would include measures to address issues associated with alterations to  
8 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
9 the rivers and streams during construction and operations of facilities located within the waterway  
10 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
11 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
12 changes in sediment accumulation near the intakes.

13 **CEQA Conclusion:** In total, Alternative 2A would include measures to address issues associated with  
14 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
15 elevations in the rivers and streams during construction and operations of facilities located within  
16 the waterway. Potential adverse impacts could occur due increased stormwater runoff from paved  
17 areas that could increase flows in local drainages; and changes in sediment accumulation near the  
18 intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
19 potential impact to a less than significant level.

20 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

21 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

22 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
23 **exceed the capacity of existing or planned stormwater drainage systems**

24 Effects associated with construction and operations of facilities under Alternative 2A would be  
25 identical to those described under Alternative 1A because the facilities would be identical.  
26 Alternative 2A actions would include installation of dewatering facilities in accordance with permits  
27 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 2A would  
28 include provisions to design the dewatering system in accordance with these to avoid adverse  
29 impacts on surface water quality and flows. However, increased runoff could occur from facilities  
30 locations during construction or operations and could result in adverse effects if the runoff volume  
31 exceeds the capacities of local drainages.

32 **CEQA Conclusion:** Alternative 2A actions would include installation of dewatering facilities in  
33 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
34 Alternative 2A would include provisions to design the dewatering system in accordance with these  
35 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
36 occur from facilities locations during construction or operations and could result in significant if the  
37 runoff volume exceeds the capacities of local drainages. These impacts are considered significant.  
38 Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

39 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

40 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

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**Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of constructed facility**

Impacts associated with construction and operations of facilities under Alternative 2A would be identical to those described under Alternative 1A because the facilities would be identical. Alternative 2A would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees.

**CEQA Conclusion:** Alternative 2A would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

**Impact SW 7. Construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject to inundation by mudflow**

Impacts associated with construction and operations of facilities under Alternative 2A would be identical to those described under Alternative 1A because the facilities would be identical. As described under Impact SW 4, Alternative 2A would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternative 2A would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 2A would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4.

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- 1     **6.3.3.6       Alternative 2B—Dual Conveyance with East Canal and Five Intakes**
- 2                   **(15,000 cfs; Operational Scenario B)**
- 3       Facilities construction under Alternative 2B would be identical to those described for Alternative 1B.
- 4       Alternative 2B could involved relocation of two of the intakes to a location south of the confluence of
- 5       Sutter and Steamboat sloughs and the Sacramento River.
- 6       Operations of the facilities and implementation of the conservation measures under Alternative 2B
- 7       would be identical to actions described under Alternative 2A.
- 8       **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**
- 9       **waters in winter and spring**
- 10      Effects on SWP and CVP reservoir storage under Alternative 2B would be identical to those
- 11      described for Impact SW 1 under Alternative 2A because the operations of the facilities would be
- 12      identical.
- 13      **CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 2B would be
- 14      identical to those described under Alternative 2A because the operations of the facilities would be
- 15      identical. Therefore, Alternative 2B would result in a less than significant impact on flood
- 16      management.
- 17      **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**
- 18      **of wet years when flood potential is high**
- 19      Effects on surface water flows under Alternative 2B would be identical to those described for Impact
- 20      SW 2 under Alternative 2A because the operations of the facilities would be identical.
- 21      **CEQA Conclusion:** Effects on surface water flows under Alternative 2B would be identical to those
- 22      described under Alternative 2A because the operations of the facilities would be identical.
- 23      Therefore, Alternative 2A would result in less than significant river flow impacts on flood
- 24      management.
- 25      **Impact SW 3. Substantial increase in reverse flow conditions in Old and Middle Rivers**
- 26      Effects on Old and Middle River flows under Alternative 2B would be identical to those described for
- 27      Impact SW 3 under Alternative 2A because the operations of the facilities would be identical.
- 28      **CEQA Conclusion:** Alternative 2B would provide benefits related to reducing reverse flows in Old
- 29      and Middle Rivers in May through March and adverse impacts in increased reverse flow conditions
- 30      in April as compared to existing conditions. Determination of the significance of this effect is related
- 31      to effects on water quality and aquatic resources. Therefore, the significance of these effects are
- 32      described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.
- 33      **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**
- 34      **the rate or amount of surface runoff**
- 35      Effects associated with construction and operations of facilities under Alternative 2B would be
- 36      identical to those described under Alternative 1B because the facilities would be identical.
- 37      In total, Alternative 2B would include measures to address issues associated with alterations to
- 38      drainage patterns, stream courses, and runoff; potential for increased surface water elevations in

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1 the rivers and streams during construction and operations of facilities located within the waterway  
2 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
3 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
4 changes in sediment accumulation near the intakes.

5 **CEQA Conclusion:** In total, Alternative 2B would include measures to address issues associated with  
6 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
7 elevations in the rivers and streams during construction and operations of facilities located within  
8 the waterway. Potential significant impacts could occur due to increased stormwater runoff from  
9 paved areas that could increase flows in local drainages and changes in sediment accumulation near  
10 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
11 potential impact to a less than significant level.

12 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

13 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

14 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
15 **exceed the capacity of existing or planned stormwater drainage systems**

16 Effects associated with construction and operations of facilities under Alternative 2B would be  
17 identical to those described under Alternative 1B because the facilities would be identical.

18 Alternative 2B actions would include installation of dewatering facilities in accordance with permits  
19 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 2B would  
20 include provisions to design the dewatering system in accordance with these to avoid adverse  
21 impacts on surface water quality and flows. However, increased runoff could occur from facilities  
22 locations during construction or operations and could result in adverse effects if the runoff volume  
23 exceeds the capacities of local drainages.

24 **CEQA Conclusion:** Alternative 2B actions would include installation of dewatering facilities in  
25 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
26 Alternative 2B would include provisions to design the dewatering system in accordance with these  
27 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
28 occur from facilities locations during construction or operations and could result in significant  
29 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered  
30 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
31 level.

32 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

33 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

34 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
35 **or death involving flooding, including flooding as a result of the failure of constructed facility**

36 Impacts associated with construction and operations of facilities under Alternative 2B would be  
37 identical to those described under Alternative 1B because the facilities would be identical.  
38 Alternative 2B would not result in an increase to exposure of people or structures to flooding due to  
39 construction or operations of the conveyance facilities or construction of the habitat restoration  
40 facilities because the facilities would be required to comply with the requirements of the USACE,

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1 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
2 areas of habitat restoration could cause potential damage to adjacent levees.

3 **CEQA Conclusion:** Alternative 2B would not result in an increase to exposure of people or structures  
4 to flooding due to construction or operations of the conveyance facilities or construction of the  
5 habitat restoration facilities because the facilities would be required to comply with the  
6 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
7 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
8 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
9 potential impact to a less than significant level.

#### 10 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

11 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

#### 12 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would** 13 **impede or redirect flood flows, or be subject to inundation by mudflow**

14 Impacts associated with construction and operations of facilities under Alternative 2B would be  
15 identical to those described under Alternative 1B because the facilities would be identical. As  
16 described under Impact SW 1, Alternative 2B would not increase flood potential on the Sacramento  
17 River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as  
18 described under Impact SW 2. Alternative 2B would include measures to address issues associated  
19 with alterations to drainage patterns, stream courses, and runoff and potential for increased surface  
20 water elevations in the rivers and streams during construction and operations of facilities. Potential  
21 adverse impacts could occur due to increased stormwater runoff from paved areas that could  
22 increase flows in local drainages; and changes in sediment accumulation near the intakes. These  
23 impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a  
24 less than significant level.

25 **CEQA Conclusion:** Alternative 2B would not result in an impedance or redirection of flood flows or  
26 conditions that would cause inundation by mudflow due to construction or operations of the  
27 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
28 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
29 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
30 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
31 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
32 potential impact to a less than significant level.

#### 33 **Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

34 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

### 35 **6.3.3.7 Alternative 2C—Dual Conveyance with West Canal and Intakes W1–** 36 **W5 (15,000 cfs; Operational Scenario B)**

37 Facilities construction under Alternative 2C would be identical to those described for Alternative 1C.  
38 Alternative 2C could involved relocation of two of the intakes to a location south of the confluence of  
39 Sutter and Steamboat sloughs and the Sacramento River. Operations would be different under

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1 Alternative 2C than Alternative 1C and would be reflected in changes in agricultural and regional  
2 economics for Upstream of the Delta and Export Service Area.

3 Operations of the facilities and implementation of the conservation measures under Alternative 2C  
4 would be identical to actions described under Alternative 2A.

5 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
6 **waters in winter and spring**

7 Effects on SWP and CVP reservoir storage under Alternative 2C would be identical to those  
8 described for Impact SW 1 under Alternative 2A because the operations of the facilities would be  
9 identical.

10 **CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 2C would be  
11 identical to those described under Alternative 2A because the operations of the facilities would be  
12 identical. Therefore, Alternative 2B would result in a less than significant impact on flood  
13 management.

14 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**  
15 **of wet years when flood potential is high**

16 Effects on surface water flows under Alternative 2C would be identical to those described for Impact  
17 SW 2 under Alternative 2A because the operations of the facilities would be identical.

18 **CEQA Conclusion:** Effects on surface water flows under Alternative 2C would be identical to those  
19 described under Alternative 2A because the operations of the facilities would be identical.  
20 Therefore, Alternative 2A would result in less than significant river flow impacts on flood  
21 management.

22 **Impact SW 3. Substantial increase in reverse flow conditions in Old and Middle Rivers**

23 Effects on Old and Middle River flows under Alternative 2C would be identical to those described for  
24 Impact SW 3 under Alternative 2A because the operations of the facilities would be identical.

25 **CEQA Conclusion:** Alternative 2C would provide benefits related to reducing reverse flows in Old  
26 and Middle Rivers in May through March and adverse impacts in increased reverse flow conditions  
27 in April as compared to existing conditions. Determination of the significance of this effect is related  
28 to effects on water quality and aquatic resources. Therefore, the significance of these effects are  
29 described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

30 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
31 **the rate or amount of surface runoff**

32 Impacts associated with construction and operations of facilities under Alternative 2C would be  
33 identical to those described under Alternative 1C because the facilities would be identical.

34 In total, Alternative 2C would include measures to address issues associated with alterations to  
35 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
36 the rivers and streams during construction and operations of facilities located within the waterway  
37 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
38 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
39 changes in sediment accumulation near the intakes.

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**CEQA Conclusion:** In total, Alternative 2C would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff; potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. Potential significant impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

**Impact SW 5. Creation or contribution of runoff water from a constructed facility which would exceed the capacity of existing or planned stormwater drainage systems.**

Effects associated with construction and operations of facilities under Alternative 2C would be identical to those described under Alternative 1C because the facilities would be identical.

Alternative 2C actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 1A would include provisions to design the dewatering system in accordance with these to avoid adverse impacts on surface water quality and flows. However, increased runoff could occur from facilities locations during construction or operations and could result in adverse effects if the runoff volume exceeds the capacities of local drainages.

**CEQA Conclusion:** Alternative 2C actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 2C would include provisions to design the dewatering system in accordance with these to avoid significant impacts on surface water quality and flows. However, increased runoff could occur from facilities locations during construction or operations and could result in significant impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

**Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of constructed facility**

Effects associated with construction and operations of facilities under Alternative 2C would be identical to those described under Alternative 1C because the facilities would be identical. Alternative 2C would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. **CEQA Conclusion:** Alternative 2C would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration

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1 facilities because the facilities would be required to comply with the requirements of the USACE,  
2 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
3 areas of habitat restoration could cause potential damage to adjacent levees. These impacts are  
4 considered significant. Mitigation Measure SW 6 would reduce this potential impact to a less than  
5 significant level.

#### 6 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

7 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

#### 8 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would** 9 **impede or redirect flood flows, or be subject to inundation by mudflow**

10 Impacts associated with construction and operations of facilities under Alternative 2C would be  
11 identical to those described under Alternative 1C because the facilities would be identical. As  
12 described under Impact SW 1, Alternative 2C would not increase flood potential on the Sacramento  
13 River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as  
14 described under Impact SW 2. Alternative 2C would include measures to address issues associated  
15 with alterations to drainage patterns, stream courses, and runoff and potential for increased surface  
16 water elevations in the rivers and streams during construction and operations of facilities. Potential  
17 adverse impacts could occur due to increased stormwater runoff from paved areas that could  
18 increase flows in local drainages; and changes in sediment accumulation near the intakes. These  
19 impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a  
20 less than significant level.

21 **CEQA Conclusion:** Alternative 2C would not result in an impedance or redirection of flood flows or  
22 conditions that would cause inundation by mudflow due to construction or operations of the  
23 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
24 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
25 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
26 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
27 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
28 potential impact to a less than significant level.

#### 29 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

30 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

#### 31 **6.3.3.8 Alternative 3—Dual Conveyance with Tunnel and Intakes 1 and 2** 32 **(6,000 cfs; Operational Scenario A)**

33 Facilities construction under Alternative 3 would be similar to those described for Alternative 1A  
34 with only two intakes.

35 Operations under Alternative 3 would be identical as under Alternative 1A except that there would  
36 be more reliance on the south Delta intakes due to less capacity provided by the north Delta intakes.

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**Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood waters in winter and spring**

Under Alternative 3, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown in Figures 6 10 through 6 13. The differences between storage under Alternative 3 and existing conditions and No Action Alternative represent changes under Alternative 3 and changes due to sea level rise and climate change.

Changes due to sea level rise and climate change are indicated through the comparison of or reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and the No Action Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May under Alternative 3 would be equal to or less than reservoir storage under No Action Late Long Term, as described in Section 6.4, Cumulative Analysis. The reduction in reservoir storage at the end of May would occur because additional water would be diverted at the north Delta intakes under Alternative 3 in the spring months as compared to the No Action Alternative. The reduced storage volumes would allow for storage of additional runoff that could reduce the potential for flooding downstream of the reservoirs. The effect would be beneficial related to flood management.

**CEQA Conclusion:** Alternative 3 would increase the ability to store runoff in the spring in the upper Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of the reservoirs. Therefore, Alternative 2B would result in a less than significant impact on flood management.

**Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months of wet years when flood potential is high**

**Sacramento River at Freeport**

Under Alternative 3, high monthly flows in the Sacramento River at Freeport in February under would be about 2% higher than flows under existing conditions and about 3% higher than flows under No Action Alternative, as shown in Figure 6 14. However, these differences represent changes under Alternative 3 and changes due to sea level rise and climate change.

High monthly flows in wet years in the Sacramento River at Freeport in February under No Action Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at Freeport.

High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative 3 would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a monthly basis, flood potential at these locations would not change under Alternative 3 as compared to No Action Alternative Late Long Term. Therefore, Alternative 3 would result in a beneficial impact on flood management.

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**1 San Joaquin River at Vernalis**

2 Under Alternative 3, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
3 would be about 5% higher than flows under existing conditions and about 6% higher under No  
4 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
5 3 and changes due to sea level rise and climate change.

6 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
7 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
8 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
9 Vernalis when flows are diverted into Paradise Cut.

10 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 3  
11 would be similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On  
12 a monthly basis, flood potential at these locations would not change under Alternative 3 as  
13 compared to No Action Alternative Late Long Term. Therefore, Alternative 3 would result in no  
14 impact on flood management.

**15 Sacramento River at Locations Upstream of Walnut Grove**

16 Under Alternative 3, high monthly flows in the Sacramento River downstream of the north Delta  
17 intakes in February would be less than under existing conditions and No Action Alternative, as  
18 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially  
19 in April through September when the flows under the No Action Alternative Late Long Term would  
20 be less than flows under No Action Alternative. However, flows downstream of the north Delta  
21 intakes would be reduced in all months on a long term average due to the operations of the north  
22 Delta intakes.

23 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
24 February under No Action Alternative Late Long Term would be about 5% higher than under No  
25 Action Alternative, as shown in Figure 6 18.

26 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
27 February under Alternative 3 would be less than flows under No Action Alternative Late Long Term,  
28 as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not change  
29 under Alternative 3 as compared to No Action Alternative Late Long Term. Therefore, Alternative 3  
30 would result in a beneficial impact on flood management.

**31 Trinity River Downstream of Lewiston Dam**

32 Under Alternative 3, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
33 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
34 shown in Figure 6 20.

35 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
36 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
37 in Figure 6 20.

38 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
39 Alternative 3 would be similar to flows under No Action Alternative Late Long Term, as shown in  
40 Figure 6 20. On a monthly basis, flood potential at these locations would not change under

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1 Alternative 3 as compared to No Action Alternative Late Long Term. Therefore, Alternative 3 would  
2 result in no impact on flood management.

3 **American River Downstream of Nimbus Dam**

4 Under Alternative 3, high monthly flows in the American River at Nimbus Dam in January and  
5 February in wet years under Alternative 3 would be 20 to 30% higher than flows under existing  
6 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
7 under Alternative 3 and changes due to sea level rise and climate change.

8 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
9 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
10 Alternative, as shown in Figure 6 22.

11 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
12 under Alternative 3 would be lower than under No Action Alternative Late Long Term, as shown in  
13 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
14 Alternative 3 as compared to No Action Alternative Late Long Term. Therefore, Alternative 3 would  
15 result in no impact on flood management.

16 **Feather River Downstream of Thermalito Dam**

17 Under Alternative 3, high monthly flows in wet years in the Feather River at Thermalito Dam in  
18 February would be 32% higher than flows under existing conditions and 43% higher than flows  
19 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
20 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

21 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
22 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
23 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
24 6 24 would not exceed channel capacity of 150,000 cfs in this location.

25 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
26 Alternative 3 would be 12% higher than under No Action Alternative Late Long Term because water  
27 is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
28 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
29 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 3  
30 would not result in an adverse impact on flood management.

31 **Yolo Bypass at Fremont Weir**

32 Under Alternative 3, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
33 years would be 38% higher than peak monthly spills under existing conditions and 41% higher than  
34 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
35 related to climate change.

36 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
37 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
38 shown in Figure 6 26.

39 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
40 Alternative 3 would be 10% higher than under No Action Alternative Late Long Term, as shown in

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1 Figure 6 26, because Alternative 3 operations criteria increases spills into the Yolo Bypass to  
2 increase the frequency and inundation period of the Yolo Bypass. as compared to existing conditions  
3 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
4 Fremont Weir. Therefore, Alternative 3 would not result in an adverse impact on flood management.

5 Overall, Alternative 3 would not result in an increase in potential risk for flood management as  
6 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
7 and climate change are eliminated from the analysis. Flows under Alternative 3 in the locations  
8 considered in this analysis either were similar to or less than flows that would occur in existing  
9 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
10 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
11 Alternative 3 would not result in adverse impacts on flood management.

12 **CEQA Conclusion:** Alternative 3 would not result in increase in potential risk for flood management  
13 as compared to existing conditions and No Action Alternative without the changes due to sea level  
14 rise and climate change are eliminated from the analysis. Flows under Alternative 3 in the locations  
15 considered in this analysis either were similar to or less than flows that would occur in existing  
16 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
17 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
18 Alternative 3 would result in a less than significant impact on flood management.

#### 19 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

20 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 3 on a  
21 long term average basis except in April and May as compared to reverse flows under existing  
22 conditions and No Action Alternative, as shown in Figure 6 27. Therefore, Alternative 3 would result  
23 in beneficial impacts toward reductions in reverse flow conditions in Old and Middle Rivers in June  
24 through March and adverse impacts with increased reverse flow conditions in April.

25 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
26 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
27 River flows would be less likely to occur on a long term average basis except in April and May as  
28 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

29 Reverse flow conditions under Alternative 3 would be less likely to occur on a long term average  
30 basis except in January, April, and May as compared to No Action Alternative Late Long Term.

31 **CEQA Conclusion:** Alternative 3 would provide benefits related to reducing reverse flows in Old and  
32 Middle Rivers in June through March and adverse impacts in increased reverse flow conditions in  
33 April and May as compared to existing conditions. Determination of the significance of this effect is  
34 related to effects on water quality and aquatic resources. Therefore, the significance of these effects  
35 are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

#### 36 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in** 37 **the rate or amount of surface runoff**

38 Impacts associated with construction and operations of facilities under Alternative 3 would be  
39 identical those described under Alternative 1A because the facilities would be identical with the  
40 exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
41 potential for effects would be less than described under Alternative 1A. However, the measures  
42 included in Alternative 1A to avoid adverse effects would be included in Alternative 3.

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1 In total, Alternative 3 would include measures to address issues associated with alterations to  
2 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
3 the rivers and streams during construction and operations of facilities located within the waterway  
4 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
5 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
6 changes in sediment accumulation near the intakes.

7 **CEQA Conclusion:** In total, Alternative 3 would include measures to address issues associated with  
8 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
9 elevations in the rivers and streams during construction and operations of facilities located within  
10 the waterway. Potential significant impacts could occur due increased stormwater runoff from  
11 paved areas that could increase flows in local drainages and changes in sediment accumulation near  
12 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
13 potential impact to a less than significant level.

#### 14 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

15 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

#### 16 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would** 17 **exceed the capacity of existing or planned stormwater drainage systems**

18 Effects associated with construction and operations of facilities under Alternative 3 would be  
19 identical those described under Alternative 1A because the facilities would be identical with the  
20 exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
21 potential for effects would be less than described under Alternative 1A.

22 Alternative 3 actions would include installation of dewatering facilities in accordance with permits  
23 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 3 would include  
24 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
25 surface water quality and flows. However, increased runoff could occur from facilities locations  
26 during construction or operations and could result in adverse effects if the runoff volume exceeds  
27 the capacities of local drainages.

28 **CEQA Conclusion:** Alternative 3 actions would include installation of dewatering facilities in  
29 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
30 Alternative 3 would include provisions to design the dewatering system in accordance with these to  
31 avoid significant impacts on surface water quality and flows. However, increased runoff could occur  
32 from facilities locations during construction or operations and could result in significant impacts if  
33 the runoff volume exceeds the capacities of local drainages. These impacts are considered  
34 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
35 level.

#### 36 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

37 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

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**Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of constructed facility**

Effects associated with construction and operations of facilities under Alternative 3 would be identical those described under Alternative 1A because the facilities would be identical with the exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore, potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 3. Therefore, Alternative 3 would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees.

**CEQA Conclusion:** Alternative 3 would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A. .

**Impact SW 7. Construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject inundation by mudflow.**

Effects associated with construction and operations of facilities under Alternative 3 would be identical those described under Alternative 1A because the facilities would be identical with the exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore, potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 3. As described under Impact SW 1, Alternative 3 would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternative 3 would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 3 would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near

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1 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
2 potential impact to a less than significant level.

3 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

4 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

5 **6.3.3.9 Alternative 4—Dual Conveyance with Tunnel and Intakes 1–3 (9,000**  
6 **cfs; Operational Scenario B)**

7 Facilities construction under Alternative 4 would be similar to those described for Alternative 1A  
8 with only three intakes.

9 Operations under Alternative 4 would be identical as under Alternative 2A except that there would  
10 be more reliance on the south Delta intakes due to less capacity provided by the north Delta intakes.

11 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
12 **waters in winter and spring**

13 Under Alternative 4, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville,  
14 and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown  
15 in Figures 6 10 through 6 13. These differences represent changes under Alternative 4 and changes  
16 due to sea level rise and climate change.

17 Changes due to sea level rise and climate change are indicated through the comparison of or  
18 reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
19 under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
20 Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
21 Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

22 Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May  
23 under Alternative 4 would be equal to or less than reservoir storage under No Action Late Long  
24 Term, as described in Section 6.4, Cumulative Analysis. The reduction in reservoir storage at the end  
25 of May would occur because additional water would be diverted at the north Delta intakes under  
26 Alternative 4 in the spring months as compared to the No Action Alternative. The reduced storage  
27 volumes would allow for storage of additional runoff that could reduce the potential for flooding  
28 downstream of the reservoirs. The effect would be beneficial related to flood management.

29 **CEQA Conclusion:** Alternative 4 would increase the ability to store runoff in the spring in the upper  
30 Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
31 the reservoirs. Therefore, Alternative 4 would result in a less than significant impact on flood  
32 management.

33 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**  
34 **of wet years when flood potential is high**

35 **Sacramento River at Freeport**

36 Under Alternative 4, high monthly flows in the Sacramento River at Freeport in February under  
37 would be about 2% higher than flows under existing conditions and 3% higher than flows under No

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- 1 Action Alternative, as shown in Figure 6 14. However, these differences represent changes under
- 2 Alternative 4 and changes due to sea level rise and climate change.
- 3 High monthly flows in wet years in the Sacramento River at Freeport in February under No Action
- 4 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown
- 5 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at
- 6 Freeport.
- 7 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative
- 8 4 would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a
- 9 monthly basis, flood potential at these locations would not change under Alternative 4 as compared
- 10 to No Action Alternative Late Long Term. Therefore, Alternative 4 would result in a beneficial
- 11 impact on flood management.
- 12 **San Joaquin River at Vernalis**
- 13 Under Alternative 4, high monthly flows in the San Joaquin River at Vernalis in March in wet years
- 14 would be about 10% higher than flows under existing conditions and about 6% higher under No
- 15 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative
- 16 4 and changes due to sea level rise and climate change.
- 17 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action
- 18 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown
- 19 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at
- 20 Vernalis when flows are diverted into Paradise Cut.
- 21 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 4
- 22 would be equal to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On a
- 23 monthly basis, flood potential at these locations would not change under Alternative 4 as compared
- 24 to No Action Alternative Late Long Term. Therefore, Alternative 4 would result in no impact on
- 25 flood management.
- 26 **Sacramento River at Locations Upstream of Walnut Grove**
- 27 Under Alternative 4, high monthly flows in the Sacramento River downstream of the north Delta
- 28 intakes in February would be less than under existing conditions and No Action Alternative, as
- 29 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially
- 30 in April through September when the flows under the No Action Alternative Late Long Term would
- 31 be less than flows under No Action Alternative. However, flows downstream of the north Delta
- 32 intakes would be reduced in all months on a long term average due to the operations of the north
- 33 Delta intakes.
- 34 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 35 February under No Action Alternative Late Long Term would be about 5% higher than under No
- 36 Action Alternative, as shown in Figure 6 18.
- 37 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 38 February under Alternative 4 would be less than flows under No Action Alternative Late Long Term,
- 39 as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not change
- 40 under Alternative 4 as compared to No Action Alternative Late Long Term. Therefore, Alternative 4
- 41 would result in a beneficial impact on flood management.

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**1 Trinity River Downstream of Lewiston Dam**

2 Under Alternative 4, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
 3 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
 4 shown in Figure 6 20.

5 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
 6 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
 7 in Figure 6 20.

8 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
 9 Alternative 4 would be similar to flows under No Action Alternative Late Long Term, as shown in  
 10 Figure 6 20. On a monthly basis, flood potential at these locations would not change under  
 11 Alternative 4 as compared to No Action Alternative Late Long Term. Therefore, Alternative 4 would  
 12 result in no impact on flood management.

**13 American River Downstream of Nimbus Dam**

14 Under Alternative 4, high monthly flows in the American River at Nimbus Dam in January and  
 15 February in wet years under Alternative 4 would be 20 to 30% higher than flows under existing  
 16 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
 17 under Alternative 4 and changes due to sea level rise and climate change.

18 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
 19 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
 20 Alternative, as shown in Figure 6 22.

21 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
 22 under Alternative 4 would be similar under No Action Alternative Late Long Term, as shown in  
 23 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
 24 Alternative 4 as compared to No Action Alternative Late Long Term. Therefore, Alternative 4 would  
 25 result in no impact on flood management.

**26 Feather River Downstream of Thermalito Dam**

27 Under Alternative 4, high monthly flows in wet years in the Feather River at Thermalito Dam in  
 28 February would be 31% higher than flows under existing conditions and 41% higher than flows  
 29 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
 30 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

31 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
 32 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
 33 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
 34 6 24 would not exceed channel capacity of 150,000 cfs in this location.

35 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
 36 Alternative 4 would be 10% higher than under No Action Alternative Late Long Term because water  
 37 is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
 38 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
 39 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 4  
 40 would not result in an adverse impact on flood management.

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1 **Yolo Bypass at Fremont Weir**

2 Under Alternative 4, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
3 years would be 36% higher than peak monthly spills under existing conditions and 39% higher than  
4 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
5 related to climate change.

6 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
7 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
8 shown in Figure 6 26.

9 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
10 Alternative 4 would be 8% higher than under No Action Alternative Late Long Term, as shown in  
11 Figure 6 26, because Alternative 4 operations criteria increases spills into the Yolo Bypass to  
12 increase the frequency and inundation period of the Yolo Bypass, as compared to existing conditions  
13 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
14 Fremont Weir. Therefore, Alternative 4 would not result in an adverse impact on flood management.

15 Overall, Alternative 4 would not result in an increase in potential risk for flood management as  
16 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
17 and climate change are eliminated from the analysis. Flows under Alternative 4 in the locations  
18 considered in this analysis either were similar to or less than flows that would occur in existing  
19 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
20 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
21 Alternative 4 would not result in adverse impacts on flood management.

22 **CEQA Conclusion:** Alternative 4 would not result in increase in potential risk for flood management  
23 as compared to existing conditions and No Action Alternative without the changes due to sea level  
24 rise and climate change are eliminated from the analysis. Flows under Alternative 4 in the locations  
25 considered in this analysis either were similar to or less than flows that would occur in existing  
26 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
27 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
28 Alternative 4 would result in a less than significant impact on flood management.

29 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

30 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 4 on a  
31 long term average basis except in April and May as compared to reverse flows under existing  
32 conditions and No Action Alternative, as shown in Figure 6 27. Therefore, Alternative 4 would result  
33 in beneficial impacts toward reductions in reverse flow conditions in Old and Middle Rivers in June  
34 through March and adverse impacts with increased reverse flow conditions in April.

35 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
36 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
37 River flows would be less likely to occur on a long term average basis except in April and May as  
38 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

39 Reverse flow conditions under Alternative 4 would be less likely to occur on a long term average  
40 basis except in April and May as compared to No Action Alternative Late Long Term.

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1 **CEQA Conclusion:** Alternative 4 would provide benefits related to reducing reverse flows in Old and  
2 Middle Rivers in June through March and adverse impacts in increased reverse flow conditions in  
3 April and May as compared to existing conditions. Determination of the significance of this effect is  
4 related to effects on water quality and aquatic resources. Therefore, the significance of these effects  
5 are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

6 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
7 **the rate or amount of surface runoff**

8 Impacts associated with construction and operations of facilities under Alternative 4 would be  
9 identical those described under Alternative 1A because the facilities would be identical with the  
10 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
11 potential for effects would be less than described under Alternative 1A. However, the measures  
12 included in Alternative 1A to avoid adverse effects would be included in Alternative 4.

13 In total, Alternative 4 would include measures to address issues associated with alterations to  
14 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
15 the rivers and streams during construction and operations of facilities located within the waterway  
16 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
17 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
18 changes in sediment accumulation near the intakes.

19 **CEQA Conclusion:** In total, Alternative 4 would include measures to address issues associated with  
20 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
21 elevations in the rivers and streams during construction and operations of facilities located within  
22 the waterway. Potential significant impacts could occur due increased stormwater runoff from  
23 paved areas that could increase flows in local drainages and changes in sediment accumulation near  
24 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
25 potential impact to a less than significant level.

26 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

27 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

28 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
29 **exceed the capacity of existing or planned stormwater drainage systems**

30 Effects associated with construction and operations of facilities under Alternative 4 would be  
31 identical those described under Alternative 1A because the facilities would be identical with the  
32 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
33 potential for effects would be less than described under Alternative 1A.

34 Alternative 4 actions would include installation of dewatering facilities in accordance with permits  
35 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 4 would include  
36 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
37 surface water quality and flows. However, increased runoff could occur from facilities locations  
38 during construction or operations and could result in adverse effects if the runoff volume exceeds  
39 the capacities of local drainages.

40 **CEQA Conclusion:** Alternative 4 actions would include installation of dewatering facilities in  
41 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.

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#### Surface Water

1 Alternative 4 would include provisions to design the dewatering system in accordance with these to  
2 avoid significant impacts on surface water quality and flows. However, increased runoff could occur  
3 from facilities locations during construction or operations and could result in significant impacts if  
4 the runoff volume exceeds the capacities of local drainages. These impacts are considered  
5 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
6 level.

#### 7 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

8 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

#### 9 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,** 10 **or death involving flooding, including flooding as a result of the failure of constructed facility**

11 Effects associated with construction and operations of facilities under Alternative 4 would be  
12 identical those described under Alternative 1A because the facilities would be identical with the  
13 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
14 potential for effects would be less than described under Alternative 1A. However, the measures  
15 included in Alternative 1A to avoid adverse effects would be included in Alternative 4. Therefore,  
16 Alternative 3 would not result in an increase to exposure of people or structures to flooding due to  
17 construction or operations of the conveyance facilities or construction of the habitat restoration  
18 facilities because the facilities would be required to comply with the requirements of the USACE,  
19 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
20 areas of habitat restoration could cause potential damage to adjacent levees.

21 **CEQA Conclusion:** Alternative 4 would not result in an increase to exposure of people or structures  
22 to flooding due to construction or operations of the conveyance facilities or construction of the  
23 habitat restoration facilities because the facilities would be required to comply with the  
24 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
25 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
26 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
27 potential impact to a less than significant level.

#### 28 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

29 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

#### 30 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would** 31 **impede or redirect flood flows, or be subject inundation by mudflow**

32 Effects associated with construction and operations of facilities under Alternative 4 would be  
33 identical those described under Alternative 1A because the facilities would be identical with the  
34 exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
35 potential for effects would be less than described under Alternative 1A. However, the measures  
36 included in Alternative 1A to avoid adverse effects would be included in Alternative 4. As described  
37 under Impact SW 1, Alternative 4 would not increase flood potential on the Sacramento River, San  
38 Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under  
39 Impact SW 2. Alternative 4 would include measures to address issues associated with alterations to  
40 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in  
41 the rivers and streams during construction and operations of facilities. Potential adverse impacts

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could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 4 would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

#### **Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4.

### **6.3.3.10 Alternative 5—Dual Conveyance with Tunnel and Intake 1 (3,000 cfs; Operational Scenario C)**

Facilities construction under Alternative 5 would be similar to those described for Alternative 1A with only one intake.

Operations under Alternative 5 would be similar as under Alternative 1A except for the following actions.

- Alternative 5 would include operations to comply with Fall X2 criteria that will increase Delta outflow in September through November when the previous years were above normal and wet water years, as in the No Action Alternative.
- Alternative 5 would include operations to restrict use of the south Delta exports through specific criteria related to the San Joaquin River inflow/export ratio.
- Alternative 5 also provides for more frequent spills into Yolo Bypass at Fremont Weir to increase frequency and extent of inundation.

#### **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood waters in winter and spring**

Under Alternative 5 reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown in Figures 6 10 through 6 13. These differences represent changes under Alternative 5 and changes due to sea level rise and climate change.

Changes due to sea level rise and climate change are indicated through the comparison of or reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake would be less than under existing conditions and the No Action Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

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1 Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May  
2 under Alternative 5 would be equal to or less than reservoir storage under No Action Late Long  
3 Term, as described in Section 6.4, Cumulative Analysis. The reduced storage volumes would allow  
4 for storage of additional runoff that could reduce the potential for flooding downstream of the  
5 reservoirs. The effect would be beneficial related to flood management.

6 **CEQA Conclusion:** Alternative 5 would increase the ability to store runoff in the spring in the upper  
7 Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
8 the reservoirs. Therefore, Alternative 5 would result in a less than significant impact on flood  
9 management.

## 10 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months** 11 **of wet years when flood potential is high**

### 12 **Sacramento River at Freeport**

13 Under Alternative 5, high monthly flows in the Sacramento River at Freeport in February under  
14 would be about 2% higher than flows under existing conditions and 3% higher than flows under No  
15 Action Alternative, as shown in Figure 6 14. However, these differences represent changes under  
16 Alternative 5 and changes due to sea level rise and climate change.

17 High monthly flows in wet years in the Sacramento River at Freeport in February under No Action  
18 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown  
19 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
20 Freeport.

21 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative  
22 5 would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
23 monthly basis, flood potential at these locations would not change under Alternative 5 as compared  
24 to No Action Alternative Late Long Term. Therefore, Alternative 5 would result in a beneficial  
25 impact on flood management.

### 26 **San Joaquin River at Vernalis**

27 Under Alternative 5, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
28 would be about 5% higher than flows under existing conditions and about 6% higher under No  
29 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
30 5 and changes due to sea level rise and climate change.

31 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
32 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
33 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
34 Vernalis when flows are diverted into Paradise Cut.

35 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 5  
36 would be similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On  
37 a monthly basis, flood potential at these locations would not change under Alternative 5 as  
38 compared to No Action Alternative Late Long Term. Therefore, Alternative 5 would result in no  
39 impact on flood management.

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**1 Sacramento River at Locations Upstream of Walnut Grove**

2 Under Alternative 5, high monthly flows in the Sacramento River downstream of the north Delta  
3 intakes in February would be less than under existing conditions and No Action Alternative, as  
4 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially  
5 in April through September when the flows under the No Action Alternative Late Long Term would  
6 be less than flows under No Action Alternative. However, flows downstream of the north Delta  
7 intakes would be reduced in all months on a long term average due to the operations of the north  
8 Delta intakes.

9 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
10 February under No Action Alternative Late Long Term would be about 5% higher than under No  
11 Action Alternative, as shown in Figure 6 18.

12 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
13 February under Alternative 5 would be less than flows under No Action Alternative Late Long Term,  
14 as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not change  
15 under Alternative 5 as compared to No Action Alternative Late Long Term. Therefore, Alternative 5  
16 would result in a beneficial impact on flood management.

**17 Trinity River Downstream of Lewiston Dam**

18 Under Alternative 5, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
19 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
20 shown in Figure 6 20.

21 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
22 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
23 in Figure 6 20.

24 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
25 Alternative 5 would be similar to flows under No Action Alternative Late Long Term, as shown in  
26 Figure 6 20. On a monthly basis, flood potential at these locations would not change under  
27 Alternative 5 as compared to No Action Alternative Late Long Term. Therefore, Alternative 5 would  
28 result in no impact on flood management.

**29 American River Downstream of Nimbus Dam**

30 Under Alternative 5, high monthly flows in the American River at Nimbus Dam in January and  
31 February in wet years under Alternative 5 would be 20 to 30% higher than flows under existing  
32 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
33 under Alternative 5 and changes due to sea level rise and climate change.

34 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
35 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
36 Alternative, as shown in Figure 6 22.

37 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
38 under Alternative 5 would be similar under No Action Alternative Late Long Term, as shown in  
39 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
40 Alternative 5 as compared to No Action Alternative Late Long Term. Therefore, Alternative 5 would  
41 result in no impact on flood management.

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# **Feather River Downstream of Thermalito Dam**

Under Alternative 5, high monthly flows in wet years in the Feather River at Thermalito Dam in February would be 30% higher than flows under existing conditions and 41% higher than flows under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

High monthly flows in wet years in the Feather River at Thermalito Dam in February under No Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure 6 24 would not exceed channel capacity of 150,000 cfs in this location.

High monthly flows in wet years in the Feather River at Thermalito Dam in February under Alternative 5 would be 10% higher than under No Action Alternative Late Long Term because water is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 5 would not result in an adverse impact on flood management.

## **Yolo Bypass at Fremont Weir**

Under Alternative 5, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years would be 28% higher than peak monthly spills under existing conditions and 38% higher than spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be related to climate change.

High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as shown in Figure 6 26.

High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under Alternative 5 would be 11% higher than under No Action Alternative Late Long Term, as shown in Figure 6 26, because Alternative 5 operations criteria increases spills into the Yolo Bypass to increase the frequency and inundation period of the Yolo Bypass. as compared to existing conditions or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at Fremont Weir. Therefore, Alternative 5 would not result in an adverse impact on flood management.

Overall, Alternative 5 would not result in an increase in potential risk for flood management as compared to existing conditions and No Action Alternative without the changes due to sea level rise and climate change are eliminated from the analysis. Flows under Alternative 5 in the locations considered in this analysis either were similar to or less than flows that would occur in existing conditions or No Action Alternative without the changes in sea level rise and climate change; or the increase in flows would be less than the flood capacity for the channels at these locations. Therefore, Alternative 5 would not result in adverse impacts on flood management.

**CEQA Conclusion:** Alternative 5 would not result in increase in potential risk for flood management as compared to existing conditions and No Action Alternative without the changes due to sea level rise and climate change are eliminated from the analysis. Flows under Alternative 5 in the locations considered in this analysis either were similar to or less than flows that would occur in existing conditions or No Action Alternative without the changes in sea level rise and climate change; or the

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1 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
2 Alternative 5 would result in a less than significant impact on flood management.

### 3 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

4 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 5 on a  
5 long term average basis except in April and May as compared to reverse flows under existing  
6 conditions and except in April as compared to No Action Alternative, as shown in Figure 6 27.  
7 Therefore, Alternative 5 would result in beneficial impacts toward reductions in reverse flow  
8 conditions in Old and Middle Rivers in June through March and adverse impacts with increased  
9 reverse flow conditions in April and May as compared to existing conditions. Alternative 5 would  
10 result in beneficial impacts toward reductions in reverse flow conditions in Old and Middle Rivers in  
11 May through March and adverse impacts with increased reverse flow conditions in April as  
12 compared to No Action Alternative.

13 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
14 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
15 River flows would be less likely to occur on a long term average basis except in April and May as  
16 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

17 Reverse flow conditions under Alternative 5 would be less likely to occur on a long term average  
18 basis except in April and December as compared to No Action Alternative Late Long Term.

19 **CEQA Conclusion:** Alternative 5 would provide benefits related to reducing reverse flows in Old and  
20 Middle Rivers in June through March and adverse impacts in increased reverse flow conditions in  
21 April and May as compared to existing conditions. Determination of the significance of this effect is  
22 related to effects on water quality and aquatic resources. Therefore, the significance of these effects  
23 are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

### 24 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in** 25 **the rate or amount of surface runoff**

26 Impacts associated with construction and operations of facilities under Alternative 5 would be  
27 identical those described under Alternative 1A because the facilities would be identical with the  
28 exception of four fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
29 potential for effects would be less than described under Alternative 1A. However, the measures  
30 included in Alternative 1A to avoid adverse effects would be included in Alternative 5.

31 In total, Alternative 5 would include measures to address issues associated with alterations to  
32 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
33 the rivers and streams during construction and operations of facilities located within the waterway  
34 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
35 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
36 changes in sediment accumulation near the intakes.

37 **CEQA Conclusion:** In total, Alternative 5 would include measures to address issues associated with  
38 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
39 elevations in the rivers and streams during construction and operations of facilities located within  
40 the waterway. Potential significant impacts could occur due increased stormwater runoff from  
41 paved areas that could increase flows in local drainages; and changes in sediment accumulation near

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1 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
2 potential impact to a less than significant level.

3 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

4 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

5 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
6 **exceed the capacity of existing or planned stormwater drainage systems**

7 Effects associated with construction and operations of facilities under Alternative 5 would be  
8 identical those described under Alternative 1A because the facilities would be identical with the  
9 exception of four fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
10 potential for effects would be less than described under Alternative 1A.

11 Alternative 5 actions would include installation of dewatering facilities in accordance with permits  
12 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 5 would include  
13 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
14 surface water quality and flows. However, increased runoff could occur from facilities locations  
15 during construction or operations and could result in adverse effects if the runoff volume exceeds  
16 the capacities of local drainages.

17 **CEQA Conclusion:** Alternative 5 actions would include installation of dewatering facilities in  
18 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
19 Alternative 5 would include provisions to design the dewatering system in accordance with these to  
20 avoid significant impacts on surface water quality and flows. However, increased runoff could occur  
21 from facilities locations during construction or operations and could result in significant impacts if  
22 the runoff volume exceeds the capacities of local drainages. These impacts are considered  
23 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
24 level.

25 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

26 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

27 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
28 **or death involving flooding, including flooding as a result of the failure of constructed facility**

29 Effects associated with construction and operations of facilities under Alternative 5 would be  
30 identical those described under Alternative 1A because the facilities would be identical with the  
31 exception of four fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
32 potential for effects would be less than described under Alternative 1A. However, the measures  
33 included in Alternative 1A to avoid adverse effects would be included in Alternative 5. Therefore,  
34 Alternative 5 would not result in an increase to exposure of people or structures to flooding due to  
35 construction or operations of the conveyance facilities or construction of the habitat restoration  
36 facilities because the facilities would be required to comply with the requirements of the USACE,  
37 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
38 areas of habitat restoration could cause potential damage to adjacent levees.

39 **CEQA Conclusion:** Alternative 5 would not result in an increase to exposure of people or structures  
40 to flooding due to construction or operations of the conveyance facilities or construction of the

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1 habitat restoration facilities because the facilities would be required to comply with the  
2 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
3 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
4 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
5 potential impact to a less than significant level.

6 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

7 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

8 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
9 **impede or redirect flood flows, or be subject inundation by mudflow**

10 Effects associated with construction and operations of facilities under Alternative 5 would be  
11 identical those described under Alternative 1A because the facilities would be identical with the  
12 exception of four fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
13 potential for effects would be less than described under Alternative 1A. However, the measures  
14 included in Alternative 1A to avoid adverse effects would be included in Alternative 5. As described  
15 under Impact SW 1, Alternative 5 would not increase flood potential on the Sacramento River, San  
16 Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under  
17 Impact SW 2. Alternative 5 would include measures to address issues associated with alterations to  
18 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in  
19 the rivers and streams during construction and operations of facilities. Potential adverse impacts  
20 could occur due to increased stormwater runoff from paved areas that could increase flows in local  
21 drainages; and changes in sediment accumulation near the intakes. These impacts are considered  
22 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
23 level.

24 **CEQA Conclusion:** Alternative 5 would not result in an impedance or redirection of flood flows or  
25 conditions that would cause inundation by mudflow due to construction or operations of the  
26 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
27 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
28 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
29 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
30 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
31 potential impact to a less than significant level.

32 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

33 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

34 **6.3.3.11 Alternative 6A—Isolated Conveyance with Tunnel and Intakes 1–5**  
35 **(15,000 cfs; Operational Scenario D)**

36 Facilities construction under Alternative 6A would be similar to those described for Alternative 1A.  
37 Operations under Alternative 6A would be identical as under Alternative 1A except that there would  
38 be more reliance on the north Delta intakes due to the elimination of the south Delta intakes; and  
39 Alternative 6A would include operations to comply with Fall X2 criteria, as in the No Action  
40 Alternative.

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**1 Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
**2 waters in winter and spring**

3 Under Alternative 6A, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville,  
 4 and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown  
 5 in Figures 6 10 through 6 13, and similar to storage conditions described under Alternative 1A  
 6 because the operational criteria would be the same in both alternatives. These differences represent  
 7 changes under Alternative 6A and changes due to sea level rise and climate change.

8 Changes due to sea level rise and climate change are indicated through the comparison of or  
 9 reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
 10 under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
 11 Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
 12 Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

13 Reservoir storages in Shasta Lake, Trinity Lake, and Lake Oroville at the end of May under  
 14 Alternative 6A would be greater than reservoir storage under No Action Late Long Term, as  
 15 described in Section 6.4, Cumulative Analysis. Reservoir storage in Folsom Lake at the end of May  
 16 under Alternative 6A would be less than or no greater than 1% increase than reservoir storage  
 17 under No Action Late Long Term, as described in Section 6.4, Cumulative Analysis. The reduced  
 18 storage volumes would allow for storage of additional runoff that could reduce the potential for  
 19 flooding downstream of the reservoirs. The effect would be beneficial related to flood management.

20 **CEQA Conclusion:** Alternative 6A would increase the ability to store runoff in the spring in the upper  
 21 Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
 22 the reservoirs. Therefore, Alternative 6A would result in a less than significant impact on flood  
 23 management.

**24 Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**  
**25 of wet years when flood potential is high**

**26 Sacramento River at Freeport**

27 Under Alternative 6A, high monthly flows in the Sacramento River at Freeport in February under  
 28 would be about 2% higher than flows under existing conditions and 3% higher than flows under No  
 29 Action Alternative, as shown in Figure 6 14. However, these differences represent changes under  
 30 Alternative 6A and changes due to sea level rise and climate change.

31 High monthly flows in wet years in the Sacramento River at Freeport in February under No Action  
 32 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown  
 33 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
 34 Freeport.

35 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative  
 36 6A would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
 37 monthly basis, flood potential at these locations would not change under Alternative 6A as  
 38 compared to No Action Alternative Late Long Term. Therefore, Alternative 6A would result in a  
 39 beneficial impact on flood management.

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**1 San Joaquin River at Vernalis**

2 Under Alternative 6A, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
3 would be about 9% higher than flows under existing conditions and about 6% higher under No  
4 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
5 6A and changes due to sea level rise and climate change.

6 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
7 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
8 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
9 Vernalis when flows are diverted into Paradise Cut.

10 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 6A  
11 would be similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On  
12 a monthly basis, flood potential at these locations would not change under Alternative 6A as  
13 compared to No Action Alternative Late Long Term. Therefore, Alternative 6A would result in no  
14 impact on flood management.

**15 Sacramento River at Locations Upstream of Walnut Grove**

16 Under Alternative 6A, high monthly flows in the Sacramento River downstream of the north Delta  
17 intakes in February would be less than under existing conditions and No Action Alternative, as  
18 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially  
19 in April through September when the flows under the No Action Alternative Late Long Term would  
20 be less than flows under No Action Alternative. However, flows downstream of the north Delta  
21 intakes would be reduced in all months on a long term average due to the operations of the north  
22 Delta intakes.

23 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
24 February under No Action Alternative Late Long Term would be about 5% higher than under No  
25 Action Alternative, as shown in Figure 6 18.

26 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
27 February under Alternative 6A would be less than flows under No Action Alternative Late Long  
28 Term, as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not  
29 change under Alternative 6A as compared to No Action Alternative Late Long Term. Therefore,  
30 Alternative 6A would result in a beneficial impact on flood management.

**31 Trinity River Downstream of Lewiston Dam**

32 Under Alternative 6A, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
33 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
34 shown in Figure 6 20.

35 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
36 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
37 in Figure 6 20.

38 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
39 Alternative 6A would be similar to flows under No Action Alternative Late Long Term, as shown in  
40 Figure 6 20. On a monthly basis, flood potential at these locations would not change under

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Surface Water

1 Alternative 6A as compared to No Action Alternative Late Long Term. Therefore, Alternative 6A  
2 would result in no impact on flood management.

3 **American River Downstream of Nimbus Dam**

4 Under Alternative 6A, high monthly flows in the American River at Nimbus Dam in January and  
5 February in wet years under Alternative 6A would be 20 to 30% higher than flows under existing  
6 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
7 under Alternative 6A and changes due to sea level rise and climate change.

8 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
9 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
10 Alternative, as shown in Figure 6 22.

11 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
12 under Alternative 6A would be 1% higher than flows under No Action Alternative Late Long Term,  
13 or similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 22. On a  
14 monthly basis, flood potential at these locations would not be adverse under Alternative 6A as  
15 compared to No Action Alternative Late Long Term. Therefore, Alternative 6A would result in no  
16 impact on flood management.

17 **Feather River Downstream of Thermalito Dam**

18 Under Alternative 6A, high monthly flows in wet years in the Feather River at Thermalito Dam in  
19 February would be 29% higher than flows under existing conditions and 29% higher than flows  
20 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
21 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

22 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
23 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
24 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
25 6 24 would not exceed channel capacity of 150,000 cfs in this location.

26 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
27 Alternative 6A would be 8% higher than under No Action Alternative Late Long Term because water  
28 is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
29 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
30 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 6A  
31 would not result in an adverse impact on flood management.

32 **Yolo Bypass at Fremont Weir**

33 Under Alternative 6A, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
34 years would be 36% higher than peak monthly spills under existing conditions and 39% higher than  
35 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
36 related to climate change.

37 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
38 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
39 shown in Figure 6 26.

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1 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
2 Alternative 6A would be 9% higher than under No Action Alternative Late Long Term, as shown in  
3 Figure 6 26, because Alternative 6A operations criteria increases spills into the Yolo Bypass to  
4 increase the frequency and inundation period of the Yolo Bypass, as compared to existing conditions  
5 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
6 Fremont Weir. Therefore, Alternative 6A would not result in an adverse impact on flood  
7 management.

8 Overall, Alternative 6A would not result in an increase in potential risk for flood management as  
9 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
10 and climate change are eliminated from the analysis. Flows under Alternative 6A in the locations  
11 considered in this analysis either were similar to or less than flows that would occur in existing  
12 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
13 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
14 Alternative 6A would not result in adverse impacts on flood management.

15 **CEQA Conclusion:** Alternative 6A would not result in increase in potential risk for flood  
16 management as compared to existing conditions and No Action Alternative without the changes due  
17 to sea level rise and climate change are eliminated from the analysis. Flows under Alternative 6A in  
18 the locations considered in this analysis either were similar to or less than flows that would occur in  
19 existing conditions or No Action Alternative without the changes in sea level rise and climate  
20 change; or the increase in flows would be less than the flood capacity for the channels at these  
21 locations. Therefore, Alternative 6A would result in a less than significant impact on flood  
22 management.

### 23 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

24 Reverse flow conditions for Old and Middle River flows would not occur under Alternative 6A  
25 because there would be no exports from the south Delta intakes to cause reverse flow conditions.  
26 Therefore, Alternative 6A would result in a beneficial impact.

27 **CEQA Conclusion:** Alternative 6A would provide benefits related to reducing reverse flows in Old  
28 and Middle Rivers in all months and the impacts would be less than significant.

### 29 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in** 30 **the rate or amount of surface runoff**

31 Impacts associated with construction and operations of facilities under Alternative 6A would be  
32 identical to those described under Alternative 1A because the facilities would be identical.

33 In total, Alternative 6A would include measures to address issues associated with alterations to  
34 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
35 the rivers and streams during construction and operations of facilities located within the waterway  
36 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
37 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
38 changes in sediment accumulation near the intakes.

39 **CEQA Conclusion:** In total, Alternative 6A would include measures to address issues associated with  
40 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
41 elevations in the rivers and streams during construction and operations of facilities located within  
42 the waterway as described in Chapter 3, Description of Alternatives. Potential significant impacts

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1 could occur due increased stormwater runoff from paved areas that could increase flows in local  
2 drainages and changes in sediment accumulation near the intakes. These impacts are considered  
3 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
4 level.

5 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

6 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

7 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would**  
8 **exceed the capacity of existing or planned stormwater drainage systems**

9 Effects associated with construction and operations of facilities under Alternative 6A would be  
10 identical to those described under Alternative 1A because the facilities would be identical.

11 Alternative 6A actions would include installation of dewatering facilities in accordance with permits  
12 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 6A would  
13 include provisions to design the dewatering system in accordance with these to avoid adverse  
14 impacts on surface water quality and flows. However, increased runoff could occur from facilities  
15 locations during construction or operations and could result in adverse effects if the runoff volume  
16 exceeds the capacities of local drainages.

17 **CEQA Conclusion:** Alternative 6A actions would include installation of dewatering facilities in  
18 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
19 Alternative 6A would include provisions to design the dewatering system in accordance with these  
20 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
21 occur from facilities locations during construction or operations and could result in significant  
22 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered  
23 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
24 level.

25 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

26 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

27 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
28 **or death involving flooding, including flooding as a result of the failure of constructed facility**

29 Effects associated with construction and operations of facilities under Alternative 6A would be  
30 identical to those described under Alternative 1A because the facilities would be identical.  
31 Alternative 6A would not result in an increase to exposure of people or structures to flooding due to  
32 construction or operations of the conveyance facilities or construction of the habitat restoration  
33 facilities because the facilities would be required to comply with the requirements of the USACE,  
34 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
35 areas of habitat restoration could cause potential damage to adjacent levees.

36 **CEQA Conclusion:** Alternative 6A would not result in an increase to exposure of people or structures  
37 to flooding due to construction or operations of the conveyance facilities or construction of the  
38 habitat restoration facilities because the facilities would be required to comply with the  
39 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
40 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent

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1 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
2 potential impact to a less than significant level.

3 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

4 See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

5 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
6 **impede or redirect flood flows, or be subject inundation by mudflow**

7 Effects associated with construction and operations of facilities under Alternative 6A would be  
8 identical to those described under Alternative 1A because the facilities would be identical. As  
9 described under Impact SW 1, Alternative 6A would not increase flood potential on the Sacramento  
10 River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as  
11 described under Impact SW 2. Alternative 6A would include measures to address issues associated  
12 with alterations to drainage patterns, stream courses, and runoff and potential for increased surface  
13 water elevations in the rivers and streams during construction and operations of facilities. Potential  
14 adverse impacts could occur due to increased stormwater runoff from paved areas that could  
15 increase flows in local drainages; and changes in sediment accumulation near the intakes. These  
16 impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a  
17 less than significant level.

18 **CEQA Conclusion:** Alternative 6A would not result in an impedance or redirection of flood flows or  
19 conditions that would cause inundation by mudflow due to construction or operations of the  
20 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
21 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
22 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
23 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
24 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
25 potential impact to a less than significant level.

26 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

27 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

28 **6.3.3.12 Alternative 6B—Isolated Conveyance with East Canal and Intakes 1–**  
29 **5 (15,000 cfs; Operational Scenario D)**

30 Facilities construction under Alternative 6B would be identical to those described for Alternative 1B.

31 Operations of the facilities and implementation of the conservation measures under Alternative 6B  
32 would be identical to actions described under Alternative 6A.

33 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
34 **waters in winter and spring**

35 Effects on SWP and CVP reservoir storage under Alternative 6B would be identical to those  
36 described for Impact SW 1 under Alternative 6A because the operations of the facilities would be  
37 identical.

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1 **CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 6B would be  
2 identical to those described under Alternative 6A because the operations of the facilities would be  
3 identical. Therefore, Alternative 6B would result in a less than significant impact on flood  
4 management.

5 **Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months**  
6 **of wet years when flood potential is high**

7 Effects on surface water flows under Alternative 6B would be identical to those described for Impact  
8 SW 2 under Alternative 6A because the operations of the facilities would be identical.

9 **CEQA Conclusion:** Effects on surface water flows under Alternative 6B would be identical to those  
10 described under Alternative 6A because the operations of the facilities would be identical.  
11 Therefore, Alternative 6B would result in less than significant flow impacts on flood management.

12 **Impact SW 3. Substantial increase in reverse flow conditions in Old and Middle Rivers**

13 Effects on Old and Middle River flows under Alternative 6B would be identical to those described for  
14 Impact SW 3 under Alternative 6A because the operations of the facilities would be identical.

15 **CEQA Conclusion:** Alternative 6B would provide benefits related to reducing reverse flows in Old  
16 and Middle Rivers in all months and the impacts would be less than significant.

17 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
18 **the rate or amount of surface runoff**

19 Impacts associated with construction and operations of facilities under Alternative 6B would be  
20 identical to those described under Alternative 1B because the facilities would be identical.

21 In total, Alternative 6B would include measures to address issues associated with alterations to  
22 drainage patterns, stream courses, and runoff; potential for increased surface water elevations in  
23 the rivers and streams during construction and operations of facilities located within the waterway  
24 as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due  
25 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
26 changes in sediment accumulation near the intakes.

27 **CEQA Conclusion:** In total, Alternative 6B would include measures to address issues associated with  
28 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
29 elevations in the rivers and streams during construction and operations of facilities located within  
30 the waterway as described in Chapter 3, Description of Alternatives. Potential significant impacts  
31 could occur due increased stormwater runoff from paved areas that could increase flows in local  
32 drainages and changes in sediment accumulation near the intakes. These impacts are considered  
33 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
34 level.

35 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

36 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

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**Impact SW 5. Creation or contribution of runoff water from a constructed facility that would exceed the capacity of existing or planned stormwater drainage systems**

Effects associated with construction and operations of facilities under Alternative 6B would be identical to those described under Alternative 1B because the facilities would be identical.

Alternative 6B actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 6B would include provisions to design the dewatering system in accordance with these to avoid adverse impacts on surface water quality and flows. However, increased runoff could occur from facilities locations during construction or operations and could result in adverse effects if the runoff volume exceeds the capacities of local drainages.

**CEQA Conclusion:** Alternative 6B actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 6B would include provisions to design the dewatering system in accordance with these to avoid significant impacts on surface water quality and flows. However, increased runoff could occur from facilities locations during construction or operations and could result in significant impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

**Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of constructed facility**

Effects associated with construction and operations of facilities under Alternative 6B would be identical to those described under Alternative 1B because the facilities would be identical.

Alternative 6B would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees.

**CEQA Conclusion:** Alternative 6B would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

See Mitigation Measure SW 6 in the discussion of Impact SW 6 under Alternative 1A.

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**Impact SW 7. Construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject inundation by mudflow**

Impacts associated with construction and operations of facilities under Alternative 6B would be identical to those described under Alternative 1B because the facilities would be identical. As described under Impact SW 1, Alternative 6B would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternative 6B would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 6B would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4.

**6.3.3.13 Alternative 6C—Isolated Conveyance with West Canal and Intakes W1–W5 (15,000 cfs; Operational Scenario D**

Facilities construction under Alternative 6C would be identical to those described for Alternative 1C. Operations of the facilities and implementation of the conservation measures under Alternative 6C would be identical to actions described under Alternative 6A.

**Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood waters in winter and spring**

Effects on SWP and CVP reservoir storage under Alternative 6C would be identical to those described for Impact SW 1 under Alternative 6A because the operations of the facilities would be identical.

**CEQA Conclusion:** Effects on SWP and CVP reservoir storage under Alternative 6C would be identical to those described under Alternative 6A because the operations of the facilities would be identical. Therefore, Alternative 6C would result in a less than significant impact on flood management.

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**Impact SW 2. Sacramento and San Joaquin River flows in the winter and early spring months of wet years when flood potential is high**

Effects on surface water flows under Alternative 6C would be identical to those described for Impact SW 2 under Alternative 6A because the operations of the facilities would be identical.

**CEQA Conclusion:** Effects on surface water flows under Alternative 6C would be identical to those described under Alternative 6A because the operations of the facilities would be identical. Therefore, Alternative 6C would result in less than significant river flow impacts on flood management.

**Impact SW 3. Substantial increase in reverse flow conditions in Old and Middle Rivers**

Effects on Old and Middle River flows under Alternative 6C would be identical to those described for Impact SW 3 under Alternative 6A because the operations of the facilities would be identical.

**CEQA Conclusion:** Alternative 6C would provide benefits related to reducing reverse flows in Old and Middle Rivers in all months and the impacts would be less than significant.

**Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in the rate or amount of surface runoff**

Impacts associated with construction and operations of facilities under Alternative 6C would be identical to those described under Alternative 1C because the facilities would be identical.

In total, Alternative 6C would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff; potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway as described in Chapter 3, Description of Alternatives. Potential adverse impacts could occur due increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes.

**CEQA Conclusion:** In total, Alternative 6C would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff; potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway as described in Chapter 3, Description of Alternatives. Potential significant impacts could occur due increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

**Impact SW 5. Creation or contribution of runoff water from a constructed facility that would exceed the capacity of existing or planned stormwater drainage systems**

Effects associated with construction and operations of facilities under Alternative 6C would be identical to those described under Alternative 1C because the facilities would be identical.

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#### Surface Water

1 Alternative 6C actions would include installation of dewatering facilities in accordance with permits  
2 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 6C would  
3 include provisions to design the dewatering system in accordance with these to avoid adverse  
4 impacts on surface water quality and flows. However, increased runoff could occur from facilities  
5 locations during construction or operations and could result in adverse effects if the runoff volume  
6 exceeds the capacities of local drainages.

7 **CEQA Conclusion:** Alternative 6C actions would include installation of dewatering facilities in  
8 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
9 Alternative 6C would include provisions to design the dewatering system in accordance with these  
10 to avoid significant impacts on surface water quality and flows. However, increased runoff could  
11 occur from facilities locations during construction or operations and could result in significant  
12 impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered  
13 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
14 level.

#### 15 **Mitigation Measure SW 5. Implement measures to reduce runoff and sedimentation**

16 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

#### 17 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss,** 18 **injury or death involving flooding, including flooding as a result of the failure of** 19 **constructed facility.**

20 Impacts associated with construction and operations of facilities under Alternative 6C would be  
21 identical to those described under Alternative 1C because the facilities would be identical.  
22 Alternative 6B would not result in an increase to exposure of people or structures to flooding due to  
23 construction or operations of the conveyance facilities or construction of the habitat restoration  
24 facilities because the facilities would be required to comply with the requirements of the USACE,  
25 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
26 areas of habitat restoration could cause potential damage to adjacent levees.

27 **CEQA Conclusion:** Alternative 6C would not result in an increase to exposure of people or structures  
28 to flooding due to construction or operations of the conveyance facilities or construction of the  
29 habitat restoration facilities because the facilities would be required to comply with the  
30 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
31 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
32 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
33 potential impact to a less than significant level.

#### 34 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

35 Wind fetch studies should be completed prior to construction of habitat restoration areas with  
36 increased open water in the Delta to determine levee protection methods for adjacent and  
37 nearby levees.

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**Impact SW 7. Construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject to inundation by mudflow.**

Effects associated with construction and operations of facilities under Alternative 6C would be identical to those described under Alternative 1C because the facilities would be identical. As described under Impact SW 1, Alternative 6C would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternative 6C would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 6C would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4.

**6.3.3.14 Alternative 7—Dual Conveyance with Tunnel, Intakes 2, 3, and 5, and Enhanced Aquatic Conservation (9,000 cfs; Operational Scenario E)**

Facilities construction under Alternative 7 would be similar to those described for Alternative 1A with only three intakes.

Operations under Alternative 7 would be similar as under Alternative 1A except for the following actions.

- Alternative 7 would include operations to comply with Fall X2 criteria that will increase Delta outflow in September through November when the previous years were above normal and wet water years, as in the No Action Alternative.
- Alternative 7 would include operations to restrict use of the south Delta exports through specific criteria to reduce reverse flows in Old and Middle River and changes to the south Delta/San Joaquin River flow ratio criteria to a greater extent than Alternative 1A. No diversions at the south Delta intakes would be allowed in April, May, October, and November.
- Alternative 7 would increase Delta outflow from January through August by increasing minimum flows in the Sacramento River at Rio Vista.
- Alternative 7 also would reduce diversions at the north Delta intakes for constant low flow pumping.

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- 1       □ Due to the restrictions on the use of south Delta intakes, more water would be diverted through
- 2       the north Delta intakes from December through July in Alternative 7 as compared to Alternative
- 3       1A. This operation increases total export patterns in the spring months and decreases total
- 4       exports in the fall months when north Delta intakes operations would be constrained by north
- 5       Delta bypass flows, as described in Chapter 3, Description of Alternatives. Delta outflow
- 6       increases in fall months in above normal and wet years to comply with Fall X2 criteria, but
- 7       decreases in other months due to increased total exports as compared to No Action Alternative
- 8       Late Long Term.
- 9       □ Alternative 7 provides for more frequent spills into Yolo Bypass at Fremont Weir to increase
- 10      frequency and extent of inundation.

#### 11       **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood** 12       **waters in winter and spring**

13       Under Alternative 7, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville,  
14       and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown  
15       in Figures 6 10 through 6 13. These differences represent changes under Alternative 7 and changes  
16       due to sea level rise and climate change.

17       Changes due to sea level rise and climate change are indicated through the comparison of or  
18       reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
19       under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
20       Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
21       Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

22       Reservoir storages in Shasta Lake, Trinity Lake, and Lake Oroville at the end of May under  
23       Alternative 7 would be greater than reservoir storage under No Action Late Long Term, as described  
24       in Section 6.4, Cumulative Analysis. Reservoir storage in Folsom Lake at the end of May under  
25       Alternative 7 would be less than or no greater than 1% increase than reservoir storage under No  
26       Action Late Long Term, as described in Section 6.4, Cumulative Analysis. The effect would be  
27       beneficial related to flood management.

28       **CEQA Conclusion:** Alternative 7 would increase the ability to store runoff in the spring in the upper  
29       Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
30       the reservoirs. Therefore, Alternative 7 would result in a less than significant impact on flood  
31       management.

#### 32       **Impact SW 2. Sacramento and San Joaquin Rivers flow in the winter and early spring months** 33       **of wet years when flood potential is high.**

##### 34       **Sacramento River at Freeport**

35       Under Alternative 7, high monthly flows in the Sacramento River at Freeport in February under  
36       would be about 2% higher than flows under existing conditions and 3% higher than flows under No  
37       Action Alternative, as shown in Figure 6 14. However, these differences represent changes under  
38       Alternative 7 and changes due to sea level rise and climate change.

39       High monthly flows in wet years in the Sacramento River at Freeport in February under No Action  
40       Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown

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1 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
2 Freeport.

3 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative  
4 7 would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
5 monthly basis, flood potential at these locations would not change under Alternative 7 as compared  
6 to No Action Alternative Late Long Term. Therefore, Alternative 7 would result in a beneficial  
7 impact on flood management.

#### 8 **San Joaquin River at Vernalis**

9 Under Alternative 7, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
10 would be about 9% higher than flows under existing conditions and about 6% higher under No  
11 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
12 7 and changes due to sea level rise and climate change.

13 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
14 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
15 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
16 Vernalis when flows are diverted into Paradise Cut.

17 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 7  
18 would be similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On  
19 a monthly basis, flood potential at these locations would not change under Alternative 7 as  
20 compared to No Action Alternative Late Long Term. Therefore, Alternative 7 would result in no  
21 impact on flood management.

#### 22 **Sacramento River at Locations Upstream of Walnut Grove**

23 Under Alternative 7, high monthly flows in the Sacramento River downstream of the north Delta  
24 intakes in February would be less than under existing conditions and No Action Alternative, as  
25 shown in Figure 6 18. A portion of the reduction in flows would be due to climate change, especially  
26 in April through September when the flows under the No Action Alternative Late Long Term would  
27 be less than flows under No Action Alternative. However, flows downstream of the north Delta  
28 intakes would be reduced in all months on a long term average due to the operations of the north  
29 Delta intakes.

30 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
31 February under No Action Alternative Late Long Term would be about 5% higher than under No  
32 Action Alternative, as shown in Figure 6 18.

33 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in  
34 February under Alternative 7 would be less than flows under No Action Alternative Late Long Term,  
35 as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not change  
36 under Alternative 7 as compared to No Action Alternative Late Long Term. Therefore, Alternative 7  
37 would result in a beneficial impact on flood management.

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**1 Trinity River Downstream of Lewiston Dam**

2 Under Alternative 7, high monthly flows in Trinity River downstream of Lewiston Lake in May in  
 3 wet years would be similar to flows under existing conditions and No Action Alternative for, as  
 4 shown in Figure 6 20.

5 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No  
 6 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown  
 7 in Figure 6 20.

8 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under  
 9 Alternative 7 would be similar to flows under No Action Alternative Late Long Term, as shown in  
 10 Figure 6 20. On a monthly basis, flood potential at these locations would not change under  
 11 Alternative 7 as compared to No Action Alternative Late Long Term. Therefore, Alternative 7 would  
 12 result in no impact on flood management.

**13 American River Downstream of Nimbus Dam**

14 Under Alternative 7, high monthly flows in the American River at Nimbus Dam in January and  
 15 February in wet years under Alternative 7 would be 20 to 30% higher than flows under existing  
 16 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes  
 17 under Alternative 7 and changes due to sea level rise and climate change.

18 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
 19 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action  
 20 Alternative, as shown in Figure 6 22.

21 High monthly flows in wet years in the American River at Nimbus Dam in January and February  
 22 under Alternative 7 would be similar to flows under No Action Alternative Late Long Term, as  
 23 shown in Figure 6 22. On a monthly basis, flood potential at these locations would not be adverse  
 24 under Alternative 7 as compared to No Action Alternative Late Long Term. Therefore, Alternative 7  
 25 would result in no impact on flood management.

**26 Feather River Downstream of Thermalito Dam**

27 Under Alternative 7, high monthly flows in wet years in the Feather River at Thermalito Dam in  
 28 February would be 19% higher than flows under existing conditions and 43% higher than flows  
 29 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
 30 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

31 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
 32 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
 33 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
 34 6 24 would not exceed channel capacity of 150,000 cfs in this location.

35 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
 36 Alternative 7 would be 11% higher than under No Action Alternative Late Long Term because water  
 37 is released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
 38 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
 39 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternative 7  
 40 would not result in an adverse impact on flood management.

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1 **Yolo Bypass at Fremont Weir**

2 Under Alternative 7, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
3 years would be 39% higher than peak monthly spills under existing conditions and 42% higher than  
4 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
5 related to climate change.

6 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
7 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
8 shown in Figure 6 26.

9 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
10 Alternative 7 would be 11% higher than under No Action Alternative Late Long Term, as shown in  
11 Figure 6 26, because Alternative 7 operations criteria increases spills into the Yolo Bypass to  
12 increase the frequency and inundation period of the Yolo Bypass, as compared to existing conditions  
13 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
14 Fremont Weir. Therefore, Alternative 7 would not result in an adverse impact on flood management.

15 Overall, Alternative 7 would not result in an increase in potential risk for flood management as  
16 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
17 and climate change are eliminated from the analysis. Flows under Alternative 7 in the locations  
18 considered in this analysis either were similar to or less than flows that would occur in existing  
19 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
20 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
21 Alternative 7 would not result in adverse impacts on flood management.

22 **CEQA Conclusion:** Alternative 7 would not result in increase in potential risk for flood management  
23 as compared to existing conditions and No Action Alternative without the changes due to sea level  
24 rise and climate change are eliminated from the analysis. Flows under Alternative 7 in the locations  
25 considered in this analysis either were similar to or less than flows that would occur in existing  
26 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
27 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
28 Alternative 7 would result in a less than significant impact on flood management.

29 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

30 Reverse flow conditions for Old and Middle River flows would not occur under Alternative 7 because  
31 of export restrictions for the south Delta intakes to avoid reverse flow conditions. Therefore,  
32 Alternative 7 would result in a beneficial impact.

33 **CEQA Conclusion:** Alternative 7 would provide benefits related to reducing reverse flows in Old and  
34 Middle Rivers in all months and the impacts would be less than significant.

35 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
36 **the rate or amount of surface runoff**

37 Impacts associated with construction and operations of facilities under Alternative 7 would be  
38 identical those described under Alternative 1A because the facilities would be identical with the  
39 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
40 potential for effects would be less than described under Alternative 1A. However, the measures  
41 included in Alternative 1A to avoid adverse effects would be included in Alternative 7.

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#### Surface Water

1 In total, Alternative 7 would include measures to address issues associated with alterations to  
2 drainage patterns, stream courses, and runoff; and potential for increased surface water elevations  
3 in the rivers and streams during construction and operations of facilities. Potential adverse impacts  
4 could occur due to increased stormwater runoff from paved areas that could increase flows in local  
5 drainages; and changes in sediment accumulation near the intakes.

6 **CEQA Conclusion:** In total, Alternative 7 would include measures to address issues associated with  
7 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
8 elevations in the rivers and streams during construction and operations of facilities located within  
9 the waterway. Potential impacts could occur due increased stormwater runoff from paved areas that  
10 could increase flows in local drainages and from changes in sediment accumulation near the intakes.  
11 These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential  
12 impact to a less than significant level. These impacts are considered significant. Mitigation Measure  
13 SW 4 would reduce this potential impact to a less than significant level.

#### 14 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

15 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

#### 16 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would** 17 **exceed the capacity of existing or planned stormwater drainage systems.**

18 Impacts associated with construction and operations of facilities under Alternative 7 would be  
19 identical those described under Alternative 1A because the facilities would be identical with the  
20 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
21 potential for effects would be less than described under Alternative 1A.

22 Alternative 7 actions would include installation of dewatering facilities in accordance with permits  
23 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 7 would include  
24 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
25 surface water quality and flows. However, increased runoff could occur from facilities locations  
26 during construction or operations and could result in adverse effects if the runoff volume exceeds  
27 the capacities of local drainages.

28 **CEQA Conclusion:** Alternative 7 actions would include installation of dewatering facilities in  
29 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
30 Alternative 7 would include provisions to design the dewatering system in accordance with these to  
31 avoid significant impacts on surface water quality and flows. However, increased runoff could occur  
32 from facilities locations during construction or operations and could result in significant impacts if  
33 the runoff volume exceeds the capacities of local drainages. These impacts are considered  
34 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
35 level.

#### 36 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

37 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

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1 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury or**  
2 **death involving flooding, including flooding as a result of the failure of constructed facility.**

3 Impacts associated with construction and operations of facilities under Alternative 7 would be  
4 identical those described under Alternative 1A because the facilities would be identical with the  
5 exception of two fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
6 potential for effects would be less than described under Alternative 1A. However, the measures  
7 included in Alternative 1A to avoid adverse effects would be included in Alternative 7. Therefore,  
8 Alternative 3 would not result in an increase to exposure of people or structures to flooding due to  
9 construction or operations of the conveyance facilities or construction of the habitat restoration  
10 facilities because the facilities would be required to comply with the requirements of the USACE,  
11 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
12 areas of habitat restoration could cause potential damage to adjacent levees.

13 **CEQA Conclusion:** Alternative 7 would not result in an increase to exposure of people or structures  
14 to flooding due to construction or operations of the conveyance facilities or construction of the  
15 habitat restoration facilities because the facilities would be required to comply with the  
16 requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased  
17 wind fetch near open water areas of habitat restoration could cause potential damage to adjacent  
18 levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this  
19 potential impact to a less than significant level.

20 **Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

21 Wind fetch studies should be completed prior to construction of habitat restoration areas with  
22 increased open water in the Delta to determine levee protection methods for adjacent and  
23 nearby levees.

24 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
25 **impede or redirect flood flows, or be subject to inundation by mudflow.**

26 Impacts associated with construction and operations of facilities under Alternative 7 would be  
27 identical those described under Alternative 1A because the facilities would be identical with the  
28 exception of three fewer intakes, pumping plants, and associated conveyance facilities. Therefore,  
29 potential for effects would be less than described under Alternative 1A. However, the measures  
30 included in Alternative 1A to avoid adverse effects would be included in Alternative 4. As described  
31 under Impact SW 1, Alternative 7 would not increase flood potential on the Sacramento River, San  
32 Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under  
33 Impact SW 2. Alternative 7 would include measures to address issues associated with alterations to  
34 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in  
35 the rivers and streams during construction and operations of facilities. Potential adverse impacts  
36 could occur due to increased stormwater runoff from paved areas that could increase flows in local  
37 drainages; and changes in sediment accumulation near the intakes. These impacts are considered  
38 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
39 level.

40 **CEQA Conclusion:** Alternative 7 would not result in an impedance or redirection of flood flows or  
41 conditions that would cause inundation by mudflow due to construction or operations of the  
42 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
43 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased

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1 flood potential. Potential adverse impacts could occur due to increased stormwater runoff from  
2 paved areas that could increase flows in local drainages; and changes in sediment accumulation near  
3 the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
4 potential impact to a less than significant level.

5 **Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**

6 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

7 **6.3.3.15 Alternative 8—Dual Conveyance with Tunnel, Intakes 2, 3, and 5,**  
8 **and Increased Delta Outflow (9,000 cfs; Operational Scenario F)**

9 *[Note to Lead Agencies: description of Alternative 8 environmental consequences and impact analysis*  
10 *is in preparation.]*

11 **6.3.3.16 Alternative 9—Separate Corridors (15,000 cfs; Operational Scenario**  
12 **G)**

13 Facilities constructed under Alternative 9 would include two fish screened intakes along the  
14 Sacramento River near Walnut Grove, fourteen operable barriers, two pumping plants and other  
15 associated facilities, two culvert siphons, three canal segments, new levees, and new channel  
16 connections. Some existing channels would also be enlarged under this alternative. Nearby areas  
17 would be altered as work or staging areas or used for the deposition of spoils.

18 Alternative 9 does not include north Delta intakes. Instead, water continues to flow by gravity from  
19 the Sacramento River into two existing channels, Delta Cross Channel and Georgiana Slough.  
20 Alternative 9 operates in a manner more similar to No Action Alternative with operational criteria  
21 related to minimizing reverse flows in Old and Middle rivers applying only to Middle River and not  
22 including San Joaquin River export/inflow ratio criteria.

23 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
24 **waters in winter and spring**

25 Under Alternative 9, reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake Oroville,  
26 and Folsom Lake would be less than under existing conditions and No Action Alternative, as shown  
27 in Figures 6 10 through 6 13. These differences represent changes under Alternative 1A and  
28 changes due to sea level rise and climate change.

29 Changes due to sea level rise and climate change are indicated through the comparison of or  
30 reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
31 under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
32 Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
33 Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

34 Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May  
35 under Alternative 9 would be equal to or less than reservoir storage under No Action Late Long  
36 Term, as described in Section 6.4, Cumulative Analysis. The reduction in reservoir storage at the end  
37 of May would occur because Alternative 9 would increase exports during winter and spring months  
38 as compared to the No Action Alternative. The reduced storage volumes would allow for storage of

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1 additional runoff that could reduce the potential for flooding downstream of the reservoirs. The  
2 effect would be beneficial related to flood management.

3 **CEQA Conclusion:** Alternative 9 would increase the ability to store runoff in the spring in the upper  
4 Sacramento River watershed, and therefore, could reduce the potential for flooding downstream of  
5 the reservoirs. Therefore, Alternative 9 would result in a less than significant impact on flood  
6 management.

7 **Impact SW 2. Sacramento and San Joaquin Rivers flow in the winter and early spring months**  
8 **of wet years when flood potential is high.**

9 **Sacramento River at Freeport**

10 Under Alternative 9, high monthly flows in the Sacramento River at Freeport in February under  
11 would be about 10% higher than flows under existing conditions and 3% higher than flows under  
12 No Action Alternative, as shown in Figure 6 14. However, these differences represent changes under  
13 Alternative 9 and changes due to sea level rise and climate change.

14 High monthly flows in wet years in the Sacramento River at Freeport in February under No Action  
15 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown  
16 in Figure 6 14. The flows would be less than the flood levels of 80,000 cfs in the Sacramento River at  
17 Freeport.

18 High monthly flows in wet years in the Sacramento River at Freeport in February under Alternative  
19 9 would be lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. On a  
20 monthly basis, flood potential at these locations would not change under Alternative 9 as compared  
21 to No Action Alternative Late Long Term. Therefore, Alternative 9 would result in a beneficial  
22 impact on flood management.

23 **San Joaquin River at Vernalis**

24 Under Alternative 9, high monthly flows in the San Joaquin River at Vernalis in March in wet years  
25 would be about 5% higher than flows under existing conditions and about 6% higher under No  
26 Action Alternative, as shown in Figure 6 16. These differences represent changes under Alternative  
27 9 and changes due to sea level rise and climate change.

28 High monthly flows in wet years in the San Joaquin River at Vernalis in March under No Action  
29 Alternative Late Long Term would be about 6% higher than under No Action Alternative, as shown  
30 in Figure 6 14. The flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at  
31 Vernalis when flows are diverted into Paradise Cut.

32 High monthly flows in wet years in the San Joaquin River at Vernalis in March under Alternative 9  
33 would be similar to flows under No Action Alternative Late Long Term, as shown in Figure 6 14. On  
34 a monthly basis, flood potential at these locations would not change under Alternative 9 as  
35 compared to No Action Alternative Late Long Term. Therefore, Alternative 9 would result in no  
36 impact on flood management.

37 **Sacramento River at Locations Upstream of Walnut Grove**

38 Under Alternative 9, high monthly flows in the Sacramento River downstream of the north Delta  
39 intakes in February would be 2% higher than under existing conditions and 3% higher than No

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Surface Water

- 1 Action Alternative, as shown in Figure 6 18. A portion of the reduction in flows would be due to
- 2 climate change, especially in April through September when the flows under the No Action
- 3 Alternative Late Long Term would be less than flows under No Action Alternative. However, flows
- 4 downstream of the north Delta intakes would be reduced in all months on a long term average due
- 5 to the operations of the north Delta intakes.
- 6 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 7 February under No Action Alternative Late Long Term would be about 5% higher than under No
- 8 Action Alternative, as shown in Figure 6 18.
- 9 High monthly flows in wet years in the Sacramento River downstream of the north Delta intakes in
- 10 February under Alternative 9 would be less than flows under No Action Alternative Late Long Term,
- 11 as shown in Figure 6 18. On a monthly basis, flood potential at these locations would not change
- 12 under Alternative 9 as compared to No Action Alternative Late Long Term. Therefore, Alternative 9
- 13 would result in a beneficial impact on flood management.
- 14 **Trinity River Downstream of Lewiston Dam**
- 15 Under Alternative 9, high monthly flows in Trinity River downstream of Lewiston Lake in May in
- 16 wet years would be similar to flows under existing conditions and No Action Alternative for, as
- 17 shown in Figure 6 20.
- 18 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under No
- 19 Action Alternative Late Long Term would be similar to flows under No Action Alternative, as shown
- 20 in Figure 6 20.
- 21 High monthly flows in wet years in Trinity River downstream of Lewiston Lake in May under
- 22 Alternative 9 would be similar to flows under No Action Alternative Late Long Term, as shown in
- 23 Figure 6 20. On a monthly basis, flood potential at these locations would not change under
- 24 Alternative 9 as compared to No Action Alternative Late Long Term. Therefore, Alternative 9 would
- 25 result in no impact on flood management.
- 26 **American River Downstream of Nimbus Dam**
- 27 Under Alternative 9, high monthly flows in the American River at Nimbus Dam in January and
- 28 February in wet years under Alternative 9 would be 20 to 30% higher than flows under existing
- 29 conditions and No Action Alternative, as shown in Figure 6 22. These differences represent changes
- 30 under Alternative 9 and changes due to sea level rise and climate change.
- 31 High monthly flows in wet years in the American River at Nimbus Dam in January and February
- 32 under No Action Alternative Late Long Term would be 20 to 30% higher than under No Action
- 33 Alternative, as shown in Figure 6 22.
- 34 High monthly flows in wet years in the American River at Nimbus Dam in January and February
- 35 under Alternative 9 would be similar to flows under No Action Alternative Late Long Term, as
- 36 shown in Figure 6 22. On a monthly basis, flood potential at these locations would not be adverse
- 37 under Alternative 9 as compared to No Action Alternative Late Long Term. Therefore, Alternative 9
- 38 would result in no impact on flood management.

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1 **Feather River Downstream of Thermalito Dam**

2 Under Alternative 9, high monthly flows in wet years in the Feather River at Thermalito Dam in  
3 February would be 18% higher than flows under existing conditions and 28% higher than flows  
4 under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted from March  
5 to February, as shown in Figure 6 24. A portion of the changes would be related to climate change.

6 High monthly flows in wet years in the Feather River at Thermalito Dam in February under No  
7 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
8 shown in Figure 6 24. The peak flows would be shifted from March to February, as shown in Figure  
9 6 24 would not exceed channel capacity of 150,000 cfs in this location.

10 High monthly flows in wet years in the Feather River at Thermalito Dam in February under  
11 Alternative 9 would be lower than flows under No Action Alternative Late Long Term. Therefore,  
12 Alternative 9 would not result in an adverse impact on flood management.

13 **Yolo Bypass at Fremont Weir**

14 Under Alternative 9, peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet  
15 years would be 31% higher than peak monthly spills under existing conditions and 35% higher than  
16 spills under No Action Alternative, as shown in Figure 6 26. A portion of the changes would be  
17 related to climate change.

18 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under No  
19 Action Alternative Late Long Term would be 28% higher than under No Action Alternative, as  
20 shown in Figure 6 26.

21 High peak monthly spills into the Yolo Bypass at Fremont Weir in February in wet years under  
22 Alternative 9 would be 5% higher than under No Action Alternative Late Long Term, as shown in  
23 Figure 6 26, because Alternative 9 operations criteria increases spills into the Yolo Bypass to  
24 increase the frequency and inundation period of the Yolo Bypass as compared to existing conditions  
25 or No Action Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at  
26 Fremont Weir. Therefore, Alternative 9 would not result in an adverse impact on flood management.

27 Overall, Alternative 9 would not result in an increase in potential risk for flood management as  
28 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
29 and climate change are eliminated from the analysis. Flows under Alternative 9 in the locations  
30 considered in this analysis either were similar to or less than flows that would occur in existing  
31 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
32 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
33 Alternative 9 would not result in adverse impacts on flood management.

34 **CEQA Conclusion:** Alternative 9 would not result in increase in potential risk for flood management  
35 as compared to existing conditions and No Action Alternative without the changes due to sea level  
36 rise and climate change are eliminated from the analysis. Flows under Alternative 9 in the locations  
37 considered in this analysis either were similar to or less than flows that would occur in existing  
38 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
39 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
40 Alternative 9 would result in a less than significant impact on flood management.

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**1 Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

2 Reverse flow conditions for Old and Middle River flows would be less likely under Alternative 9 on a  
3 long term average basis except in December, February, April, and May as compared to reverse flows  
4 under existing conditions; and except in September, November, December, April, and May as  
5 compared to conditions under No Action Alternative, as shown in Figure 6 27. Therefore,  
6 Alternative 9 would result in beneficial impacts toward reductions in reverse flow conditions in Old  
7 and Middle Rivers in the majority of months with adverse impacts with increased reverse flow  
8 conditions in four months under existing conditions and five months under No Action Alternative.

9 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
10 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
11 River flows would be less likely to occur on a long term average basis except in April and May as  
12 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

13 Reverse flow conditions under Alternative 9 would be less likely to occur on a long term average  
14 basis only in June as compared to No Action Alternative Late Long Term.

15 **CEQA Conclusion:** Alternative 9 would provide benefits related to reducing reverse flows in Old and  
16 Middle Rivers in eight months and adverse impacts in increased reverse flow conditions in four  
17 months as compared to existing conditions. Determination of the significance of this effect is related  
18 to effects on water quality and aquatic resources. Therefore, the significance of these effects are  
19 described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic Resources.

**20 Impact SW 4. Substantial alteration of the existing drainage patterns or substantial increase**  
**21 in the rate or amount of surface runoff**

22 Construction of the facilities under Alternative 9 would involved construction of fish screens,  
23 operable barriers, armored levees, and setback levees in the water; dredging; associated facilities on  
24 adjacent lands; and habitat restoration in the water.

25 Construction of the facilities included in Alternative 9 would require excavation, grading, or  
26 stockpiling at project facility sites or at temporary work sites. These activities would result in  
27 temporary and long term changes to drainage patterns, paths and facilities that would, in turn,  
28 cause changes in drainage flow rates, directions and velocities.

29 Site grading needed to construct any of the proposed facilities has the potential to block, reroute, or  
30 temporarily detain and impound surface water in existing drainages, which would result in  
31 increases and decreases in flow rates, velocities, and water surface elevations. Changes in drainage  
32 depths would vary depending on the specific conditions at each of the temporary work sites. As  
33 drainage paths would be blocked by construction activities, the temporary ponding of drainage  
34 water could occur and result in decreases in drainage flow rates downstream of the new facilities,  
35 increases in water surface elevations, and decreases in velocities upstream of the new facilities.  
36 Alternative 9 facilities would temporarily and directly affect existing water bodies and drainage  
37 facilities.

38 Alternative 9 would include installation of temporary drainage bypass facilities, long term cross  
39 drainage, and replacement of existing drainage facilities that would be disrupted due to construction  
40 of new facilities. These facilities would be constructed prior to disconnecting or crossing existing  
41 drainage facilities, as described in Chapter 3, Description of Alternatives.

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Surface Water

1 Paving, compaction of soil and other activities that would increase land imperviousness could result  
2 in decreases in precipitation infiltration into the soil, and could increase drainage runoff flows into  
3 receiving drainages.

4 Removal of groundwater during construction (dewatering) would be required for excavation  
5 activities. Groundwater removed during construction would be treated as necessary (see Chapter 3,  
6 Description of Alternatives, and Chapter 7, Groundwater), and discharged to local drainage channels  
7 or rivers. This would result in a localized increase in flows and water surface elevations in the  
8 receiving channels. Dewatering would be a continuous operation initiated one to four weeks prior to  
9 excavation and would continue until the excavation is completed. The discharge rates of water  
10 collected during construction would be relatively small compared to the capacities of most of the  
11 Delta channels where discharges would occur. Dispersion facilities would be used to reduce the  
12 potential for channel erosion due to the discharge of dewatering flows. Permits for the discharges  
13 would be obtained from the Regional Water Quality Control Board.

14 Construction of facilities within water bodies would include the installation of cofferdams at each  
15 location. The cofferdams would impede river flows, resulting in hydraulic impacts. Water surface  
16 elevations upstream of the cofferdams could increase under flood flow conditions by approximately  
17 1/2 foot relative to existing conditions and No Action Alternative. Under existing regulations, the  
18 USACE, CVFPB, and DWR would require installation of setback levees or other measures to maintain  
19 existing flow capacity in the waterways during construction and operations, which would prevent  
20 unacceptable increases in river water surface elevations under flood flow conditions.

21 Construction of project facilities could impact agricultural irrigation delivery and return flow canals,  
22 pumps and other drainage facilities in locations where such agricultural facilities would be crossed  
23 or disrupted along existing levees. Stockpiled excavated material from dredging operations could  
24 impact agricultural irrigation deliveries and return flows. Alternative 9 would include installation of  
25 temporary agricultural flow bypass facilities and provision of replacement drainage facilities to  
26 avoid interruptions in agricultural irrigation deliveries or return flows. The temporary flow bypass  
27 facilities would be installed and connected before existing facilities would be disconnected or  
28 otherwise impacted. Replacement drainage facilities would be installed and connected before the  
29 end of construction.

30 Riparian habitat restoration is anticipated to occur primarily in association with the restoration of  
31 tidal marsh habitat, channel margin habitat, and inundated floodplains. The restored vegetation has  
32 the potential of increasing channel and/or floodplain roughness, which could result in increases in  
33 channel water surface elevations, including under flood flow conditions, and in decreased velocities.  
34 Modified channel geometries, although expected to be minimal, has the potential to increase or  
35 decrease channel velocities and/or channel water surface elevations, including under flood flow  
36 conditions. Alternative 9 would include measures to make the habitat restoration projects flood  
37 neutral as required by USACE, CVFPB, and DWR in accordance with existing regulatory  
38 requirements. Measures to reduce flood potential could include channel dredging to increase  
39 channel capacities and decrease channel velocities and/or water surface elevations. Dredging could  
40 be required periodically to maintain tidal circulation.

41 Expansion of seasonally inundated floodplain restoration areas generally would decrease flows in  
42 the existing channels under higher flow conditions, resulting in lower channel velocities and water  
43 surface elevations. Hydraulic roughness in the inundated floodplain areas could vary based on the  
44 land use that would be allowed there, whether riparian vegetation would be allowed to establish,

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1 farming would be continued, or residual crop biomass would be used to provide cover,  
2 hydrodynamic complexity, and organic carbon sources. However, because these inundated areas  
3 would provide new flow area relative to existing conditions and No Action Alternative, the overall  
4 hydraulic effect in the existing channels would be to lower channel velocities and water surface  
5 elevations under high flow conditions.

6 In total, Alternative 9 would include measures to address issues associated with alterations to  
7 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in  
8 the rivers and streams during construction and operations of facilities. Potential adverse impacts  
9 could occur due increased stormwater runoff from paved areas that could increase flows in local  
10 drainages; and changes in sediment accumulation near the intakes.

11 **CEQA Conclusion:** In total, Alternative 9 would include measures to address issues associated with  
12 alterations to drainage patterns, stream courses, and runoff; potential for increased surface water  
13 elevations in the rivers and streams during construction and operations of facilities located within  
14 the waterway. Potential impacts could occur due to increased stormwater runoff from paved areas  
15 that could increase flows in local drainages and from changes in sediment accumulation near the  
16 intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this  
17 potential impact to a less than significant level.

#### 18 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

19 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

#### 20 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would** 21 **exceed the capacity of existing or planned stormwater drainage systems**

22 Construction of the facilities under Alternative 9 would contribute runoff from dewater facilities. As  
23 described under Impact SW 4, paving, compaction of soil and other activities that would increase  
24 land imperviousness would result in decreases in precipitation infiltration into the soil, and thus  
25 increase drainage runoff flows into receiving drainages. Drainage studies would be completed to  
26 determine the need for onsite stormwater detention storage during construction or operations.

27 Removal of groundwater during construction (dewatering) would be required for excavation  
28 activities. Groundwater removed during construction would be treated as necessary (see Chapter 8,  
29 Water Quality), and discharged to local drainage channels or rivers. This could result in a localized  
30 increase in flows and water surface elevations in the receiving channels. Dewatering would be a  
31 continuous operation initiated one to four weeks prior to excavation and would continue after  
32 excavation is completed. The discharge rates of water collected during construction would be  
33 relatively small compared to the capacities of most of the Delta channels where discharges would  
34 occur. Dispersion facilities would be used to reduce the potential for channel erosion due to the  
35 discharge of dewatering flows. Permits for the discharges would be obtained from the Regional  
36 Water Quality Control Board, USACE, and CVFPB.

37 Alternative 9 actions would include installation of dewatering facilities in accordance with permits  
38 issued by the Regional Water Quality Control Board, USACE, and CVFPB. Alternative 9 would include  
39 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
40 surface water quality and flows. However, increased runoff could occur from facilities locations  
41 during construction or operations and could result in adverse effects if the runoff volume exceeds  
42 the capacities of local drainages.

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1 **CEQA Conclusion:** Alternative 9 actions would include installation of dewatering facilities in  
2 accordance with permits issued by the Regional Water Quality Control Board, USACE, and CVFPB.  
3 Alternative 9 would include provisions to design the dewatering system in accordance with these to  
4 avoid significant impacts on surface water quality and flows. However, increased runoff could occur  
5 from facilities locations during construction or operations and could result in significant impacts if  
6 the runoff volume exceeds the capacities of local drainages. These impacts are considered  
7 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
8 level.

9 **Mitigation Measure SW 5. Implement measures to reduce runoff and sedimentation**

10 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

11 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury,**  
12 **or death involving flooding, including flooding as a result of the failure of constructed facility.**

13 As described under Impact SW 4, facilities under Alternative 9 would be designed to avoid increased  
14 flood potential as compared to existing conditions or No Action Alternative in accordance with the  
15 requirements of the USACE, CVFPB, and DWR. As described under Impact SW 1, Alternative 9 would  
16 not increase flood potential on the Sacramento River, San Joaquin River, or Yolo Bypass.

17 Construction of facilities under Alternative 9 that would disturb existing levees would be required  
18 by USACE, CVFPB, and DWR to be designed in a manner that would not adversely effect existing  
19 flood protection. Facilities construction would include temporary cofferdams, stability analyses,  
20 monitoring and slope remediation, as described in Chapter 3, Description of Alternatives. For the  
21 slope stability impacts due to excavation of existing levees for installation of fish screens and  
22 operable barriers, sheet pile wall installation would minimize the slope stability impacts during  
23 construction. Dewatering inside the cofferdams or adjacent to the existing levees would remove  
24 waterside slope resistance and lead to slope instability. Slopes would be constructed in accordance  
25 with existing engineering standards, as described in Chapter 3, Description of Alternatives.

26 Some project facilities could require rerouting of access roads and waterways that could be used  
27 during times of evacuation or emergency response.

28 Construction of tidal marsh habitat, channel margin habitat, and inundated floodplains could  
29 increase flood potential due to impacts on adjacent levees. The newly flooded areas would have  
30 larger wind fetch lengths compared to the existing fetch lengths of the adjacent leveed channels. An  
31 increase in fetch length would result in increases in wave height and velocities that reach the  
32 existing levees along adjacent islands and floodplains. These potential increases in wave action  
33 could also reach the land side of the remaining existing levees around the restoration area.

34 Alternative 9 would be designed to avoid increased flood potential as compared to existing  
35 conditions or No Action Alternative in accordance with the requirements of the USACE, CVFPB, and  
36 DWR.

37 Alternative 9 would not result in an increase to exposure of people or structures to flooding due to  
38 construction or operations of the conveyance facilities or construction of the habitat restoration  
39 facilities because the facilities would be required to comply with the requirements of the USACE,  
40 CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water  
41 areas of habitat restoration could cause potential damage to adjacent levees.

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**CEQA Conclusion:** Alternative 9 would not result in an increase to exposure of people or structures to flooding due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW 6 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 6. Implement measures to address potential wind fetch issues**

Wind fetch studies should be completed prior to construction of habitat restoration areas with increased open water in the Delta to determine levee protection methods for adjacent and nearby levees.

**Impact SW 7. Construction of a facility within a 100 year flood hazard area that would impede or redirect flood flows, or be subject to inundation by mudflow**

As described under Impact SW 4, facilities under Alternative 9 would be designed to avoid increased flood potential as compared to existing conditions or No Action Alternative in accordance with the requirements of the USACE, CVFPB, and DWR. As described under Impact SW 1, Alternative 9 would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternative 9 would include measures to address issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**CEQA Conclusion:** Alternative 9 would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

**Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

See Mitigation Measure SW 4 in the discussion of Impact SW 4.

## 6.3.4 Cumulative Analysis

### Assessment Methodology

Surface water resources effects in the Delta Region and in the areas Upstream of the Delta and in Export Service Area would be expected to change as a result of past, present, and reasonably foreseeable future projects, related to changes in potential risks of floods, surface water flows, and drainage and changes in stream courses during construction and operations of new facilities.

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Surface Water

- 1 When the effects of the changes in surface water resources under the alternatives are considered in
- 2 connection with the potential effects of projects listed in Chapter 3, Description of Alternatives, the
- 3 potential effects range from beneficial to potentially adverse cumulative effects on surface water
- 4 resources.
- 5 The cumulative analysis includes a quantitative analysis of changes due to sea level rise and climate
- 6 change through the comparison of results from CALSIM II modeling for No Action Alternative Late
- 7 Long Term as compared to the alternatives, as described in Section 6.3.3. The cumulative analysis
- 8 also includes a qualitative analysis of the following projects that could effect surface water resources
- 9 if they were implemented, however, specific operations of these projects and related effects cannot
- 10 be determined at this time because these projects are not fully defined or analyzed.
- 11 □ North Delta Flood Control and Ecosystem Restoration Project: Project that will modify certain
- 12 levees in a portion of the North Delta (near McCormick Williamson Tract) to reduce flood
- 13 hazards. In addition, an off channel detention basin is planned to be built to improve channel
- 14 capacity on Staten Island(DWR 2010d). Environmental impact report has been completed and
- 15 indicates no adverse effects on surrounding surface waters and benefits for local flood
- 16 management. Project is undergoing further study at this time.
- 17 □ Dutch Slough Tidal Marsh Restoration Project: Project that will include levee breaches and the
- 18 restoration of a dendritic tidal channel system on three parcels between Dutch Slough and
- 19 Contra Costa Canal (DWR 2010e). Environmental impact report has been completed and
- 20 indicates no adverse effects on surrounding surface waters.
- 21 □ Los Vaqueros Reservoir Expansion Project: Project that will increase the storage capacity of Los
- 22 Vaqueros Reservoir and divert additional water from the Delta intake near Rock Slough to fill
- 23 the additional storage volume (Reclamation and CCWD 2009). First phase is being constructed.
- 24 The second phase has been evaluated in an environmental impact report/environmental impact
- 25 statement that indicate no adverse effects on surrounding surface waters.
- 26 Davis Woodland Water Supply Project: Project that will divert water on the Sacramento River
- 27 upstream of the American River confluence to be conveyed to a new water treatment plant (City
- 28 of Davis and City of Woodland 2007). An environmental impact report has been completed and
- 29 indicates no significant adverse effects on surrounding surface waters.
- 30 □ San Joaquin River Restoration Program: Program that aims at restoring flows to the San Joaquin
- 31 River from Friant Dam to the confluence of Merced River (Reclamation 2011). A draft
- 32 environmental impact report has been completed and indicates no significant adverse effects on
- 33 surrounding surface waters and benefits for local surface water flows. Project is undergoing
- 34 further study at this time.
- 35 All of these projects have completed draft or final environmental documents that analyzed their
- 36 potential impacts on surface water resources. According to these documents, the impacts on surface
- 37 water resources would be less than significant or less than significant after mitigation measures
- 38 would be implemented.
- 39 All of these projects would either specifically improve flood management conditions and reduce
- 40 flood potential, including the North Delta Flood Control and Ecosystem Restoration Project that
- 41 would expand the floodplain to reduce peak flood flows; divert additional water that could reduce
- 42 peak flood flows, including Los Vaqueros Reservoir Expansion Project and Davis Woodland Water

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1 Supply Project; or not substantially modify peak flows in wet years, such as Dutch Slough Tidal  
2 Marsh Restoration Project and San Joaquin River Restoration Program.

3 **Impact SW 1. SWP or CVP reservoir storage in May as indicator of the ability to store flood**  
4 **waters in winter and spring**

5 **No Action Alternative**

6 Changes due to sea level rise and climate change are indicated through the comparison of or  
7 reservoir storage under No Action Alternative Late Long Term as compared to reservoir storage  
8 under No Action Alternative. Reservoir storage at the end of May in Shasta Lake, Trinity Lake, Lake  
9 Oroville, and Folsom Lake would be less than under existing conditions and the No Action  
10 Alternative, as shown in Figures 6 10 through 6 13, due to sea level rise and climate change.

11 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, and 9**

12 Reservoir storages in Shasta Lake, Trinity Lake, Lake Oroville, and Folsom Lake at the end of May in  
13 wet and above normal water year types under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C,  
14 7, and 9 would be equal to or less than reservoir storage under No Action Late Long Term, as shown  
15 in Figures 6 10 through 6 13. The reduced storage volumes would allow for storage of additional  
16 runoff that could reduce the potential for flooding downstream of the reservoirs. The effect would  
17 be beneficial related to flood management.

18 Implementation of other projects listed above to be considered under the cumulative analysis would  
19 not be anticipated to result in a change in SWP and CVP reservoir storage in May based upon  
20 information presented in environmental documentation for these projects related to surface water  
21 resources.

22 **CEQA Conclusion:** Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, and 9 would increase the  
23 ability to store runoff in the spring in the upper Sacramento River watershed, and therefore, could  
24 reduce the potential for flooding downstream of the reservoirs. Therefore, Alternative 1A, 1B, 1C  
25 would result in a less than significant impact on flood management.

26 **Impact SW 2. Sacramento and San Joaquin rivers flows in the winter and early spring months**  
27 **of wet years when flood potential is high.**

28 **No Action Alternative**

29 **Sacramento River at Freeport.** High monthly flows in wet years in the Sacramento River at  
30 Freeport in February under No Action Alternative Late Long Term would be about 5% higher than  
31 under No Action Alternative, as shown in Figure 6 14. The flows would be less than the flood levels  
32 of 80,000 cfs in the Sacramento River at Freeport. Therefore, on a monthly basis, flood potential at  
33 these locations would not change under No Action Alternative as compared to No Action Alternative  
34 Late Long Term.

35 **San Joaquin River at Vernalis.** High monthly flows in wet years in the San Joaquin River at Vernalis  
36 in March under No Action Alternative Late Long Term would be about 6% higher than under No  
37 Action Alternative, as shown in Figure 6 14. The flows would be less than the flood levels of 15,000  
38 cfs in the San Joaquin River at Vernalis when flows are diverted into Paradise Cut.

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- 1 **Sacramento River at Locations Upstream of Walnut Grove.** High monthly flows in wet years in
- 2 the Sacramento River downstream of the north Delta intakes in February under No Action
- 3 Alternative Late Long Term would be about 5% higher than under No Action Alternative, as shown
- 4 in Figure 6 18.
- 5 **Trinity River Downstream of Lewiston Dam.** High monthly flows in wet years in Trinity River
- 6 downstream of Lewiston Lake in May under No Action Alternative Late Long Term would be similar
- 7 to flows under No Action Alternative, as shown in Figure 6 20.
- 8 **American River Downstream of Nimbus Dam.** High monthly flows in wet years in the American
- 9 River in January and February under No Action Alternative Late Long Term would be 20 to 30%
- 10 higher than under No Action Alternative, as shown in Figure 6 22.
- 11 **Feather River Downstream of Thermalito Dam.** High monthly flows in wet years in the Feather
- 12 River at Thermalito Dam in February under No Action Alternative Late Long Term would be 28%
- 13 higher than under No Action Alternative, as shown in Figure 6 24. The peak flows would be shifted
- 14 from March to February, as shown in Figure 6 24 and would not exceed channel capacity of 150,000
- 15 cfs in this location.
- 16 **Yolo Bypass at Fremont Weir.** High peak monthly spills into the Yolo Bypass at Fremont Weir in
- 17 February in wet years under No Action Alternative Late Long Term would be 28% higher than
- 18 under No Action Alternative, as shown in Figure 6 26.
- 19 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7**
- 20 **Sacramento River at Freeport.** High monthly flows in wet years in the Sacramento River at
- 21 Freeport in February under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would be
- 22 similar to or lower than under No Action Alternative Late Long Term, as shown in Figure 6 14. The
- 23 flows would be less than the flood levels of 80,000 cfs in the Sacramento River at Freeport.
- 24 Therefore, on a monthly basis, flood potential at these locations would not change under
- 25 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 as compared to No Action Alternative
- 26 Late Long Term, and these alternatives would result in no impact on flood management.
- 27 **San Joaquin River at Vernalis.** High monthly flows in wet years in the San Joaquin River at Vernalis
- 28 in March under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would be similar to or
- 29 lower than the flows under No Action Alternative Late Long Term, as shown in Figure 6 16. The
- 30 flows would be less than the flood levels of 15,000 cfs in the San Joaquin River at Vernalis when
- 31 flows are diverted into Paradise Cut. Therefore, on a monthly basis, flood potential at these locations
- 32 would not change under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 as compared to
- 33 No Action Alternative Late Long Term, and these alternatives would result in no impact on flood
- 34 management.
- 35 **Sacramento River at Locations Upstream of Walnut Grove.** High monthly flows in wet years in
- 36 the Sacramento River downstream of the north Delta intakes in February under Alternatives 1A, 1B,
- 37 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would be lower than flows under No Action Alternative Late
- 38 Long Term, as shown in Figure 6 18. On a monthly basis, flood potential at these locations would
- 39 not change under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 as compared to No
- 40 Action Alternative Late Long Term, and these alternatives would result in no impact on flood
- 41 management.

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## Surface Water

1 **Trinity River Downstream of Lewiston Dam.** High monthly flows in the Trinity River downstream  
2 of Lewiston Lake in May under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would be  
3 similar to or lower than the flows under No Action Alternative Late Long Term, as shown in Figure  
4 6 20. On a monthly basis, flood potential at these locations would not change under Alternatives 1A,  
5 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 as compared to No Action Alternative Late Long Term,  
6 and these alternatives would result in no impact on flood management.

7 **American River Downstream of Nimbus Dam.** High monthly flows in wet years in the American  
8 River in January and February under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7  
9 would be similar to or lower than flows under No Action Alternative Late Long Term, as shown in  
10 Figure 6 22. On a monthly basis, flood potential at these locations would not change under  
11 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 as compared to No Action Alternative  
12 Late Long Term, and these alternatives would result in no impact on flood management.

13 **Feather River Downstream of Thermalito Dam.** High monthly flows in wet years in the Feather  
14 River at Thermalito Dam in February under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C,  
15 and 7 would be 8 to 18% higher than under No Action Alternative Late Long Term because water is  
16 released from Lake Oroville for diversions at the north Delta intakes in the winter months, as  
17 described in Chapter 5, Water Supply. However, the average monthly flows in the high monthly  
18 flows would not exceed channel capacity of 150,000 cfs in this location. Therefore, Alternatives 1A,  
19 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would result in no impact on flood management.

20 **Yolo Bypass at Fremont Weir.** High peak monthly spills into the Yolo Bypass at Fremont Weir in  
21 February in wet years under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would be 5  
22 to 11% higher than under No Action Alternative Late Long Term, as shown in Figure 6 26, because  
23 Alternative 1A operations criteria increases spills into the Yolo Bypass to increase the frequency  
24 and inundation period of the Yolo Bypass, as compared to existing conditions or No Action  
25 Alternative. The flows would be less than the Yolo Bypass capacity of 343,000 cfs at Fremont Weir.  
26 Therefore, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would result in no impact on  
27 flood management.

28 Overall, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would not result in increase in  
29 potential risk for flood management as compared to existing conditions and No Action Alternative  
30 without the changes due to sea level rise and climate change are eliminated from the analysis. Flows  
31 under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 in the locations considered in this  
32 analysis either were similar to or less than flows that would occur in existing conditions or No  
33 Action Alternative without the changes in sea level rise and climate change; or the increase in flows  
34 would be less than the flood capacity for the channels at these locations. Therefore, Alternatives 1A,  
35 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would result in no impacts on flood management.

36 Implementation of other projects listed above to be considered under the cumulative analysis would  
37 not be anticipated to result in a change in surface water flows in the locations considered based  
38 upon information presented in environmental documentation for these projects related to surface  
39 water resources.

40 **CEQA Conclusion:** Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would not result in  
41 increase in potential risk for flood management as compared to existing conditions and No Action  
42 Alternative without the changes due to sea level rise and climate change are eliminated from the  
43 analysis. Flows under Alternatives 1A, 1B, 1C, 3, 4, 5, 6A, 6B, 6C, and 7 in the locations considered in  
44 this analysis either were similar to or less than flows that would occur in existing conditions or No

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1 Action Alternative without the changes in sea level rise and climate change; or the increase in flows  
2 would be less than the flood capacity for the channels at these locations. Therefore, Alternatives 1A,  
3 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, and 7 would result in a less than significant impact on flood  
4 management.

#### 5 **Alternative 9**

6 **Sacramento River at Freeport.** High monthly flows in wet years in the Sacramento River at  
7 Freeport in February under Alternative 9 would be similar to or lower than under No Action  
8 Alternative Late Long Term, as shown in Figure 6 14. The flows would be less than the flood levels  
9 of 80,000 cfs in the Sacramento River at Freeport. Therefore, on a monthly basis, flood potential at  
10 these locations would not change under Alternative 9 as compared to No Action Alternative Late  
11 Long Term, and these alternatives would result in no impact on flood management.

12 **San Joaquin River at Vernalis.** High monthly flows in wet years in the San Joaquin River at Vernalis  
13 in March under Alternative 9 would be similar to or lower than the flows under No Action  
14 Alternative Late Long Term, as shown in Figure 6 16. The flows would be less than the flood levels  
15 of 15,000 cfs in the San Joaquin River at Vernalis when flows are diverted into Paradise Cut.  
16 Therefore, on a monthly basis, flood potential at these locations would not change under Alternative  
17 9 as compared to No Action Alternative Late Long Term, and these alternatives would result in no  
18 impact on flood management.

19 **Sacramento River at Locations Upstream of Walnut Grove.** High monthly flows in wet years in  
20 the Sacramento River downstream of the north Delta intakes in February under Alternative 9 would  
21 be lower than flows under No Action Alternative Late Long Term, as shown in Figure 6 18. On a  
22 monthly basis, flood potential at these locations would not change under Alternative 9 as compared  
23 to No Action Alternative Late Long Term, and these alternatives would result in no impact on flood  
24 management.

25 **Trinity River Downstream of Lewiston Dam.** High monthly flows in the Trinity River downstream  
26 of Lewiston Lake in May under Alternative 9 would be similar to or lower than the flows under No  
27 Action Alternative Late Long Term, as shown in Figure 6 20. On a monthly basis, flood potential at  
28 these locations would not change under Alternative 9 as compared to No Action Alternative Late  
29 Long Term, and these alternatives would result in no impact on flood management.

30 **American River Downstream of Nimbus Dam.** High monthly flows in wet years in the American  
31 River in January and February under Alternative 9 would be similar to or lower than flows under No  
32 Action Alternative Late Long Term, as shown in Figure 6 22. On a monthly basis, flood potential at  
33 these locations would not change under Alternative 9 as compared to No Action Alternative Late  
34 Long Term, and these alternatives would result in no impact on flood management.

35 **Feather River Downstream of Thermalito Dam.** High monthly flows in wet years in the Feather  
36 River at Thermalito Dam in February under Alternative 9 would be lower than flows under No  
37 Action Alternative Late Long Term because water is released from Lake Oroville for diversions at  
38 the north Delta intakes in the winter months, as described in Chapter 5, Water Supply. Therefore,  
39 Alternative 9 would result in no impact on flood management.

40 **Yolo Bypass at Fremont Weir.** High peak monthly spills into the Yolo Bypass at Fremont Weir in  
41 February in wet years under Alternative 9 would be 5% higher than under No Action Alternative  
42 Late Long Term, as shown in Figure 6 26, because Alternative 1A operations criteria increases  
43 spills into the Yolo Bypass to increase the frequency and inundation period of the Yolo Bypass. as

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1 compared to existing conditions or No Action Alternative. The flows would be less than the Yolo  
2 Bypass capacity of 343,000 cfs at Fremont Weir. Therefore, Alternative 9 would result in no impact  
3 on flood management.

4 Overall, Alternative 9 would not result in increase in potential risk for flood management as  
5 compared to existing conditions and No Action Alternative without the changes due to sea level rise  
6 and climate change are eliminated from the analysis. Flows under Alternative 9 in the locations  
7 considered in this analysis either were similar to or less than flows that would occur in existing  
8 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
9 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
10 Alternative 9 would result in no impacts on flood management.

11 Implementation of other projects listed above to be considered under the cumulative analysis would  
12 not be anticipated to result in a change in surface water flows in the locations considered based  
13 upon information presented in environmental documentation for these projects related to surface  
14 water resources.

15 **CEQA Conclusion:** Alternative 9 would not result in increase in potential risk for flood management  
16 as compared to existing conditions and No Action Alternative without the changes due to sea level  
17 rise and climate change are eliminated from the analysis. Flows under Alternative 9 in the locations  
18 considered in this analysis either were similar to or less than flows that would occur in existing  
19 conditions or No Action Alternative without the changes in sea level rise and climate change; or the  
20 increase in flows would be less than the flood capacity for the channels at these locations. Therefore,  
21 Alternative 9 would result in a less than significant impact on flood management.

#### 22 **Impact SW 3. Reverse flow conditions in Old and Middle Rivers**

##### 23 **No Action Alternative**

24 Reverse flow conditions in Old and Middle Rivers would be affected by sea level rise and climate  
25 change. Under the No Action Alternative Late Long Term Reverse flow conditions for Old and Middle  
26 River flows would be less likely to occur on a long term average basis except in April and May as  
27 compared to reverse flows under No Action Alternative, as shown in Figure 6 27.

##### 28 **Alternatives 1A, 1B, and 1C**

29 Reverse flow conditions for Old and Middle River flows would be less likely in most months on a  
30 long term average basis under Alternatives 1A, 1B, and 1C compared to flows under No Action  
31 Alternative Late Long Term, as shown in Figure 6 27, and would be a benefit in these months.  
32 Reverse flow conditions would increase in October and April under Alternatives 1A, 1B, and 1C as  
33 compared to No Action Alternative Late Long Term and would be an adverse impact in these  
34 months.

35 Implementation of other projects listed above to be considered under the cumulative analysis would  
36 not be anticipated to result in increased reverse flows in Old and Middle River because these  
37 projects would not increase diversions over existing conditions and No Action Alternative based  
38 upon information presented in environmental documentation for these projects related to surface  
39 water resources.

40 **CEQA Conclusion:** Alternatives 1A, 1B, and 1C would provide benefits related to reducing reverse  
41 flows in Old and Middle Rivers in most months, and adverse impacts in increased reverse flow

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1 conditions in October and April as compared to No Action Alternative Late Long Term.  
 2 Determination of the significance of this effect is related to effects on water quality and aquatic  
 3 resources. Therefore, the significance of these effects are described in Chapter 8, Water Quality, and  
 4 Chapter 11, Fisheries and Aquatic Resources.

#### 5 **Alternatives 2A, 2B, and 2C**

6 Reverse flow conditions for Old and Middle River flows would be less likely in most months on a  
 7 long term average basis under Alternatives 2A, 2B, and 2C compared to flows under No Action  
 8 Alternative Late Long Term, as shown in Figure 6 27, and would be a benefit in these months.  
 9 Reverse flow conditions would increase in April under Alternatives 2A, 2B, and 2C as compared to  
 10 No Action Alternative Late Long Term and would be an adverse impact in this month.

11 Implementation of other projects listed above to be considered under the cumulative analysis would  
 12 not be anticipated to result in increased reverse flows in Old and Middle River because these  
 13 projects would not increase diversions over existing conditions and No Action Alternative based  
 14 upon information presented in environmental documentation for these projects related to surface  
 15 water resources.

16 **CEQA Conclusion:** Alternatives 2A, 2B, and 2C would provide benefits related to reducing reverse  
 17 flows in Old and Middle Rivers in most months, and adverse impacts in increased reverse flow  
 18 conditions in April as compared to No Action Alternative Late Long Term. Determination of the  
 19 significance of this effect is related to effects on water quality and aquatic resources. Therefore, the  
 20 significance of these effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and  
 21 Aquatic Resources.

#### 22 **Alternatives 3 and 4**

23 Reverse flow conditions for Old and Middle River flows would be less likely in most months on a  
 24 long term average basis under Alternatives 3 and 4 compared to flows under No Action Alternative  
 25 Late Long Term, as shown in Figure 6 27, and would be a benefit in these months. Reverse flow  
 26 conditions would increase in April and May under Alternatives 3 and 4 as compared to No Action  
 27 Alternative Late Long Term and would be an adverse impact in these months.

28 Implementation of other projects listed above to be considered under the cumulative analysis would  
 29 not be anticipated to result in increased reverse flows in Old and Middle River because these  
 30 projects would not increase diversions over existing conditions and No Action Alternative based  
 31 upon information presented in environmental documentation for these projects related to surface  
 32 water resources.

33 **CEQA Conclusion:** Alternatives 3 and 4 would provide benefits related to reducing reverse flows in  
 34 Old and Middle Rivers in most months, and adverse impacts in increased reverse flow conditions in  
 35 April and May as compared to No Action Alternative Late Long Term. Determination of the  
 36 significance of this effect is related to effects on water quality and aquatic resources. Therefore, the  
 37 significance of these effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and  
 38 Aquatic Resources.

#### 39 **Alternative 5**

40 Reverse flow conditions for Old and Middle River flows would be less likely in most months on a  
 41 long term average basis under Alternative 5 compared to flows under No Action Alternative Late

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1 Long Term, as shown in Figure 6 27, and would be a benefit in these months. Reverse flow  
2 conditions would increase in April and December under Alternative 5 as compared to No Action  
3 Alternative Late Long Term and would be an adverse impact in these months.

4 Implementation of other projects listed above to be considered under the cumulative analysis would  
5 not be anticipated to result in increased reverse flows in Old and Middle River because these  
6 projects would not increase diversions over existing conditions and No Action Alternative based  
7 upon information presented in environmental documentation for these projects related to surface  
8 water resources.

9 **CEQA Conclusion:** Alternative 5 would provide benefits related to reducing reverse flows in Old and  
10 Middle Rivers in most months, and adverse impacts in increased reverse flow conditions in April  
11 and December as compared to No Action Alternative Late Long Term. Determination of the  
12 significance of this effect is related to effects on water quality and aquatic resources. Therefore, the  
13 significance of these effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and  
14 Aquatic Resources.

#### 15 **Alternatives 6A, 6B, 6C, and 7**

16 Reverse flow conditions for Old and Middle River flows would be not occur on a long term average  
17 basis under Alternatives 6A, 6B, 6C, and 7 compared to flows under No Action Alternative Late Long  
18 Term, as shown in Figure 6 27; therefore, Alternatives 6A, 6B, 6C, and 7 would result in beneficial  
19 impacts.

20 Implementation of other projects listed above to be considered under the cumulative analysis would  
21 not be anticipated to result in increased reverse flows in Old and Middle River because these  
22 projects would not increase diversions over existing conditions and No Action Alternative based  
23 upon information presented in environmental documentation for these projects related to surface  
24 water resources.

25 **CEQA Conclusion:** Alternatives 6A, 6B, 6C, and 7 would provide benefits related to reducing reverse  
26 flows in Old and Middle Rivers in all months as compared to No Action Alternative Late Long Term.

#### 27 **Alternative 9**

28 Reverse flow conditions for Old and Middle River flows would be less likely in all months except  
29 June on a long term average basis under Alternative 9 compared to flows under No Action  
30 Alternative Late Long Term, as shown in Figure 6 27, and would be a benefit in these months.  
31 Reverse flow conditions would increase in June under Alternative 9 as compared to No Action  
32 Alternative Late Long Term and would be an adverse impact in this month.

33 Implementation of other projects listed above to be considered under the cumulative analysis would  
34 not be anticipated to result in increased reverse flows in Old and Middle River because these  
35 projects would not increase diversions over existing conditions and No Action Alternative based  
36 upon information presented in environmental documentation for these projects related to surface  
37 water resources.

38 **CEQA Conclusion:** Alternative 9 would provide benefits related to reducing reverse flows in Old and  
39 Middle Rivers in all months except in June, and adverse impacts in increased reverse flow conditions  
40 in June as compared to No Action Alternative Late Long Term. Determination of the significance of  
41 this effect is related to effects on water quality and aquatic resources. Therefore, the significance of

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1 these effects are described in Chapter 8, Water Quality, and Chapter 11, Fisheries and Aquatic  
2 Resources.

3 **Impact SW 4. Substantial alteration of the existing drainage pattern or substantial increase in**  
4 **the rate or amount of surface runoff**

5 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9**

6 Construction of the facilities under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would  
7 involved construction of facilities in the water and extensive facilities on the land, as well as  
8 construction of habitat restoration in the water.

9 Construction of the facilities on the land under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9  
10 would require excavation, grading, or stockpiling at project facility sites or at temporary work sites.  
11 These activities would result in temporary and long term changes to drainage patterns, paths and  
12 facilities that would, in turn, cause changes in drainage flow rates, directions and velocities. These  
13 changes would be located near the construction sites and would not result in regional changes.

14 Site grading needed to construct any of the proposed facilities has the potential to block, reroute, or  
15 temporarily detain and impound surface water in existing drainages, which would result in  
16 increases and decreases in flow rates, velocities, and water surface elevations. Changes in drainage  
17 depths would vary depending on the specific conditions at each of the temporary work sites. As  
18 drainage paths would be blocked by construction activities, the temporary ponding of drainage  
19 water could occur and result in decreases in drainage flow rates downstream of the new facilities,  
20 increases in water surface elevations, and decreases in velocities upstream of the new facilities.  
21 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 facilities could temporarily and directly affect  
22 existing water bodies and drainage facilities.

23 These temporary changes in drainage would be minimized, and in some cases avoided, by  
24 construction of new or modified drainage facilities, as described in the Chapter 3, Description of  
25 Alternatives. Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would include installation of  
26 temporary drainage bypass facilities, long term cross drainage, and replacement of existing  
27 drainage facilities that would be disrupted due to construction of new facilities. These facilities  
28 would be constructed prior to disconnecting or crossing existing drainage facilities. Locations of  
29 stockpiles and other temporary construction features would be selected to minimize flow  
30 impedance under flood flow conditions.

31 Paving, compaction of soil and other activities that would increase land imperviousness would  
32 result in decreases in precipitation infiltration into the soil, and thus increase drainage runoff flows  
33 into receiving drainages.

34 Removal of groundwater during construction (dewatering) would be required for excavation  
35 activities. Groundwater removed during construction would be treated as necessary (see Chapter 3,  
36 Description of Alternatives, and Chapter 8, Water Quality), and discharged to local drainage  
37 channels or rivers. This would result in a localized increase in flows and water surface elevations in  
38 the receiving channels. Dewatering would be a continuous operation initiated one to four weeks  
39 prior to excavation and would continue after excavation is completed. The discharge rates of water  
40 collected during construction would be relatively small compared to the capacities of most of the  
41 Delta channels where discharges would occur. Dispersion facilities would be used to reduce the

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- 1 potential for channel erosion due to the discharge of dewatering flows. Permits for the discharges
- 2 would be obtained from the Regional Water Quality Control Board.
- 3 Construction of structures in the waterways would occur under Alternatives 1A, 1B, 1C, 2A, 2B, 2C,
- 4 3, 4, 5, 6, 7, and 9 and could include the installation of cofferdams. The cofferdams would impede
- 5 river flows, resulting in hydraulic impacts. Water surface elevations upstream of the cofferdams
- 6 could increase under flood flow conditions by approximately 1/2 foot relative to No Action
- 7 Alternative Late Long Term conditions. Under existing regulations, the USACE, CVFPB, and DWR
- 8 would require installation of setback levees or other measures to maintain existing flow capacity in
- 9 the waterways during construction and operations of any structure located within the water, which
- 10 would prevent unacceptable increases in river water surface elevations under flood flow conditions,
- 11 reverse flow areas, areas of high velocities that could result in scour, and reflection of flood waves
- 12 towards other levees.
- 13 Sediment and debris would accumulate at locations of structures constructed in the water and
- 14 periodic dredging would occur, as described in Chapter 3, Description of Alternatives.
- 15 Construction of facilities could impact agricultural irrigation delivery and return flow canals, pumps
- 16 and other drainage facilities in locations where such agricultural facilities would be disturbed.
- 17 Stockpiled excavated or dredged material could impact agricultural irrigation deliveries and return
- 18 flows. Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would include installation of temporary
- 19 agricultural flow bypass facilities and provision of replacement drainage facilities to avoid
- 20 interruptions in agricultural irrigation deliveries or return flows, as described in Chapter 3,
- 21 Description of Alternatives. The temporary flow bypass facilities would be installed and connected
- 22 before existing facilities would be disconnected or otherwise impacted. Replacement drainage
- 23 facilities would be installed and connected before the end of construction of the proposed
- 24 conveyance facilities.
- 25 Riparian habitat restoration is anticipated to occur primarily in association with the restoration of
- 26 tidal marsh habitat, channel margin habitat, and inundated floodplains. The restored vegetation has
- 27 the potential of increasing channel and/or floodplain roughness, which could result in increases in
- 28 channel water surface elevations, including under flood flow conditions, and in decreased velocities.
- 29 Modified channel geometries could increase or decrease channel velocities and/or channel water
- 30 surface elevations, including under flood flow conditions. Under existing regulations, the USACE,
- 31 CVFPB, and DWR would require the habitat restoration projects to be flood neutral. Measures to
- 32 reduce flood potential could include channel dredging to increase channel capacities and decrease
- 33 channel velocities and/or water surface elevations.
- 34 Expansion of seasonally inundated floodplain restoration areas generally would decrease flows in
- 35 the existing channels under higher flow conditions, resulting in lower channel velocities and water
- 36 surface elevations. Hydraulic roughness in the inundated floodplain areas could vary based on the
- 37 land use that would be allowed there, whether riparian vegetation would be allowed to establish,
- 38 farming would be continued, or residual crop biomass would be used to provide cover,
- 39 hydrodynamic complexity, and organic carbon sources. However, because these inundated areas
- 40 would provide new flow area relative to existing conditions and No Action Alternative, the overall
- 41 hydraulic effect in the existing channels would be to lower channel velocities and water surface
- 42 elevations under high flow conditions.
- 43 In total, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would include measures to address
- 44 issues associated with alterations to drainage patterns, stream courses, and runoff; potential for

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1 increased surface water elevations in the rivers and streams during construction and operations of  
2 facilities located within the waterway as described in Chapter 3, Description of Alternatives.  
3 Potential adverse impacts could occur due increased stormwater runoff from paved areas that could  
4 increase flows in local drainages; and changes in sediment accumulation near structures  
5 constructed within the waterways.

6 Implementation of other projects listed above to be considered under the cumulative analysis would  
7 not be anticipated to result in increased runoff or changed drainages based upon information  
8 presented in environmental documentation for these projects related to surface water resources.

9 **CEQA Conclusion:** In total, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would include  
10 measures to address issues associated with alterations to drainage patterns, stream courses, and  
11 runoff; potential for increased surface water elevations in the rivers and streams during  
12 construction and operations of facilities located within the waterway as described in Chapter 3,  
13 Description of Alternatives. Potential adverse impacts could occur due increased stormwater runoff  
14 from paved areas that could increase flows in local drainages; and changes in sediment  
15 accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW 4  
16 would reduce this potential impact to a less than significant level.

#### 17 **Mitigation Measure SW 4. Implement measures to reduce runoff and sedimentation**

18 See Mitigation Measure SW 4 in the discussion of Impact SW 4 under Alternative 1A.

#### 19 **Impact SW 5. Creation or contribution of runoff water from a constructed facility that would** 20 **exceed the capacity of existing or planned stormwater drainage systems.**

#### 21 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9**

22 Construction of the facilities under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would  
23 contribute runoff from dewater facilities. As described under Impact SW 4, paving, compaction of  
24 soil and other activities that would increase land imperviousness would result in decreases in  
25 precipitation infiltration into the soil, and could increase drainage runoff flows into receiving  
26 drainages.

27 Removal of groundwater during construction (dewatering) would be required for excavation  
28 activities. Groundwater removed during construction would be treated as necessary (see Chapter 8,  
29 Water Quality), and discharged to local drainage channels or rivers. This would result in a localized  
30 increase in flows and water surface elevations in the receiving channels. Dewatering would be a  
31 continuous operation initiated one to four weeks prior to excavation and would continue after  
32 excavation is completed. The discharge rates of water collected during construction would be  
33 relatively small compared to the capacities of most of the Delta channels where discharges would  
34 occur. Dispersion facilities would be used to reduce the potential for channel erosion due to the  
35 discharge of dewatering flows. Permits for the discharges would be obtained from the Regional  
36 Water Quality Control Board, USACE, and CVFPB.

37 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 actions would include installation of  
38 dewatering facilities in accordance with permits issued by the Regional Water Quality Control  
39 Board, USACE, and CVFPB. Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would include  
40 provisions to design the dewatering system in accordance with these to avoid adverse impacts on  
41 surface water quality and flows. However, increased runoff could occur from facilities locations

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- 1 during construction or operations and could result in adverse effects if the runoff volume exceeds
- 2 the capacities of local drainages.
- 3 Implementation of other projects listed above to be considered under the cumulative analysis would
- 4 not be anticipated to result in increased runoff or changed drainages based upon information
- 5 presented in environmental documentation for these projects related to surface water resources.
- 6 **CEQA Conclusion:** Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 actions would include
- 7 installation of dewatering facilities in accordance with permits issued by the Regional Water Quality
- 8 Control Board, USACE, and CVFPB. Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would
- 9 include provisions to design the dewatering system in accordance with these to avoid adverse
- 10 impacts on surface water quality and flows. However, increased runoff could occur from facilities
- 11 locations during construction or operations and could result in adverse effects if the runoff volume
- 12 exceeds the capacities of local drainages. These impacts are considered significant. Mitigation
- 13 Measure SW 4 would reduce this potential impact to a less than significant level.
- 14 **Mitigation Measure SW 5. Creation or contribution of runoff water from a constructed**
- 15 **facility which would exceed the capacity of existing or planned stormwater drainage**
- 16 **systems.**
- 17 Please refer to Mitigation Measure SW 4 under Impact SW 4 above.
- 18 **Impact SW 6. Increased exposure of people or structures to a significant risk of loss, injury or**
- 19 **death involving flooding, including flooding as a result of the failure of constructed facility.**
- 20 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9**
- 21 As described under Impact SW 4, facilities under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and
- 22 9 would be designed to avoid increased flood potential as compared to existing conditions or No
- 23 Action Alternative in accordance with the requirements of the USACE, CVFPB, and DWR. As
- 24 described under Impact SW 1, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would not
- 25 increase flood potential on the Sacramento River, San Joaquin River, or Yolo Bypass.
- 26 Construction of facilities that would disturb existing levees would be required by USACE, CVFPB,
- 27 and DWR to be designed in a manner that would not adversely effect existing flood protection.
- 28 Facilities construction would include temporary cofferdams, stability analyses, monitoring and slope
- 29 remediation, as described in Chapter 3, Description of Alternatives. For the slope stability impacts
- 30 due to excavation of the existing levee for installation of new structures, sheet pile wall installation
- 31 would minimize the slope stability impacts during construction. For the slope stability impacts due
- 32 to excavation of the existing levees without structures, tie back wall installation and dewatering to
- 33 maintain slope stability and control seepage would minimize the slope stability impacts associated
- 34 with construction. Dewatering inside the cofferdams or adjacent to the existing levees would
- 35 remove waterside slope resistance and lead to slope instability. Slopes would be constructed in
- 36 accordance with existing engineering standards, as described in Chapter 3, Description of
- 37 Alternatives.
- 38 Some project facilities could require rerouting of access roads and waterways that could be used
- 39 during times of evacuation or emergency response.
- 40 Construction of tidal marsh habitat, channel margin habitat, and inundated floodplains could
- 41 increase flood potential due to impacts on adjacent levees. The newly flooded areas would have

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1 larger wind fetch lengths compared to the existing fetch lengths of the adjacent leveed channels. An  
2 increase in fetch length would result in increases in wave height and velocities that reach the  
3 existing levees along adjacent islands and floodplains. These potential increases in wave action  
4 could also reach the land side of the remaining existing levees around the restoration area.

5 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would be designed to avoid increased flood  
6 potential as compared to existing conditions or No Action Alternative in accordance with the  
7 requirements of the USACE, CVFPB, and DWR.

8 Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would not result in an increase to exposure of  
9 people or structures to flooding due to construction or operations of the conveyance facilities or  
10 construction of the habitat restoration facilities because the facilities would be required to comply  
11 with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However,  
12 increased wind fetch near open water areas of habitat restoration could cause potential damage to  
13 adjacent levees. This impact could become more substantial with sea level rise and climate change.

14 Implementation of other projects listed above to be considered under the cumulative analysis would  
15 not be anticipated to result in increased risk from floods based upon information presented in  
16 environmental documentation for these projects related to surface water resources.

17 **CEQA Conclusion:** Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would not result in an  
18 increase to exposure of people or structures to flooding due to construction or operations of the  
19 conveyance facilities or construction of the habitat restoration facilities because the facilities would  
20 be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased  
21 flood potential. However, increased wind fetch near open water areas of habitat restoration could  
22 cause potential damage to adjacent levees. These impacts are considered significant. Mitigation  
23 Measure SW 6 would reduce this potential impact to a less than significant level. This impact could  
24 become more substantial with sea level rise and climate change.

25 **Mitigation Measure SW 6. Increased exposure of people or structures to a significant risk**  
26 **of loss, injury or death involving flooding, including flooding as a result of the failure of**  
27 **constructed facility.**

28 Wind fetch studies should be completed prior to construction of habitat restoration areas with  
29 increased open water in the Delta to determine levee protection methods for adjacent and  
30 nearby levees.

31 **Impact SW 7. Construction of a facility within a 100 year flood hazard area that would**  
32 **impede or redirect flood flows, or be subject inundation by mudflow.**

33 **Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9**

34 As described under Impact SW 4, facilities under Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and  
35 9 would be designed to avoid increased flood potential as compared to existing conditions or No  
36 Action Alternative in accordance with the requirements of the USACE, CVFPB, and DWR. As  
37 described under Impact SW 1, Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would not  
38 increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River,  
39 or Feather River, or Yolo Bypass, as described under Impact SW 2. Alternatives 1A, 1B, 1C, 2A, 2B,  
40 2C, 3, 4, 5, 6, 7, and 9 would include measures to address issues associated with alterations to  
41 drainage patterns, stream courses, and runoff and potential for increased surface water elevations in

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1 the rivers and streams during construction and operations of facilities. Potential adverse impacts  
2 could occur due to increased stormwater runoff from paved areas that could increase flows in local  
3 drainages; and changes in sediment accumulation near the intakes. These impacts are considered  
4 significant. Mitigation Measure SW 4 would reduce this potential impact to a less than significant  
5 level.

6 Implementation of other projects listed above to be considered under the cumulative analysis would  
7 not be anticipated to result in increased risk from floods or mudflows based upon information  
8 presented in environmental documentation for these projects related to surface water resources.

9 **CEQA Conclusion:** Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6, 7, and 9 would not result in an  
10 impedance or redirection of flood flows or conditions that would cause inundation by mudflow due  
11 to construction or operations of the conveyance facilities or construction of the habitat restoration  
12 facilities because the facilities would be required to comply with the requirements of the USACE,  
13 CVFPB, and DWR to avoid increased flood potential. Potential adverse impacts could occur due to  
14 increased stormwater runoff from paved areas that could increase flows in local drainages; and  
15 changes in sediment accumulation near the intakes. These impacts are considered significant.  
16 Mitigation Measure SW 4 would reduce this potential impact to a less than significant level.

17 **Mitigation Measure SW 4 . Implement measures to reduce runoff and sedimentation**  
18 See Mitigation Measure SW 4 in the discussion of Impact SW 4.

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